Gas Journal

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Editorial Notes

The Industrial Centres

THE paper read by Mr. W. Dieterichs at the last meeting of the Southern Association of Gas Engineers and Managers, describing the work of an Industrial Centre, is an important one. It demonstrates positively the enormous value of the Development Scheme inaugurated last year. Eight of the ten Centres which have been formed have now been formally constituted, while two (Bristol and Scottish) are provisionally working in with the scheme. The membership of the eight Centres is 227. Considering that the latest Board of Trade return relates to 727 statutory undertakings, the present membership of the Centres cannot be considered satisfactory. Yet we cannot conceive of a gas undertaking which has no potential industrial or "commercial" business. In which connection we are reminded of a story worth repeating here. A few years ago the manager of an undertaking in a more or less country district said it was no use thinking he had a field for the industrial use of gas. Dr. C. M. Walter, of Birmingham, made a bet that he could find an avenue there, and on investigation he discovered there was a dairyman who sent his milk churns away to be repaired. Before long the dairyman was persuaded to install a number of gas-heated tinsmiths' sets. Now he is not only doing his own repair work but is actually making his own churns; and he has given a well worth while load to the local gas undertaking. There are always innumerable commercial applications for gas. There are few districts, for instance, where there are not possibilities of heating loads of a specialized character in dairies, bakeries, dry-cleaning shops, butchers' shops, fish-frying establishments, and so on.

It must be remembered, too, that the public regards the Industry as a whole, and the mistakes or inefficiency of one undertaking react on the whole Industry. As Mr. Dieterichs points out in his paper, whenever a potential gas load is held by a competing fuel, the information quickly spreads and is used by our competitors. Again, take the case of a large firm having branch works throughout the country. If the gas equipment at any branch is allowed to fall into an inefficient state it is obviously a target for our competitors, and if the load is lost a reaction will be felt at every other branch, to the disadvantage of the gas undertakings concerned. As an extreme example, the author told his audience of a London firm which has recently installed expensive electric furnaces for the sole reason that its parent company in the United States had been persuaded to do the same. All undertakings, whether their areas of supply are regarded as residential or industrial, should leave no stone unturned to ensure that the most modern equipment is put forward for every process; and in this regard the Industrial Centres are of enormous help. Those undertakings outside the Scheme are doing both themselves and the Gas Industry in general incalculable harm. We hope that the paper by Mr. Dieterichs will force this fact home, and that it will result in more universal support of the Development Scheme—a splendidly planned and organized Scheme which has already been most fruitful in increased gas business and in adding to the Gas Industry's prestige.

Co-operation with Appliance Makers

IT is over six years since we urged the setting-up of a Central Information Bureau. Thanks to the Gas Development Scheme of 1933 this has now been brought into being and is operating to the benefit of all concerned. A whole-time staff collects and files information so that it is available for the Centres when required. In a very short time a large amount of information originating in all parts of the country will be available not only at the Central Information Bureau but also at all Centres. The correlation work of the Centres is effected by monthly meetings of a Technical Sub-Committee composed of representatives of each Centre, together with representatives of the national bodies. Inquiries from any one Centre are circulated to the other Centres, so that, in effect, any undertaking belonging to a Centre can obtain the assistance of the whole organization. Member undertakings benefit from the activities of the Centres in connection with the design of appliances and co-operation with manufacturers of equipment. In fact, many new loads may be expected through apparatus sold and installed directly by the manufacturers. As an example Mr. Dieterichs quotes the case of a boiler designed at Watson House to develop an entirely new load for gas. The bakery engineer responsible for its manufacture has already installed over one hundred on the districts of provincial undertakings. We fail to understand why any undertaking should stand aloof from such an excellent system when the benefits are so apparent.

In his paper Mr. Dieterichs refers especially to the working of the largest Centre—the Gas Light and Coke Company—which has a membership of 74, but his remarks on general policy are applicable to all Centres. He very rightly stresses the necessity for co-operation with the manufacturers of appliances. It is essential that the personnel of the Centres should realize that they are engaged to assist in the sale of gas. Otherwise there is a possibility that all manner of complications may arise, and that instead of becoming a sales section they will tend to develop into manufacturers competing with the existing suppliers of industrial equipment and driving

them into the adoption of alternative fuels in the design of their appliances. This is the last thing for which a Development Centre should be used. Competition between gas undertakings and suppliers of equipment should be avoided at all costs. If we compete with the manufacturers, they will turn in self-defence to the use of other fuels. Our best friends will become our enemies.

By " manufacturers " Mr. Dieterichs means not only the great firms of furnace and oven builders, boiler makers, and heating engineers, but also those thousand-and-one firms manufacturing appliances which require heat in any form. During the past few years the majority of manufacturers have made great advances, and even in those districts where industrial departments are organized to the highest degree large quantities of gas-consuming plant are being sold direct, without the assistance of the gas undertakings. On the other hand, there is room for improvement, and in some cases makers have been slow to improve their products. It is only by co-operation between the Gas Industry and the maker that development will keep pace with changing competitive conditions. Since this policy of co-operation was adopted at Watson House the sale of industrial equipment has increased out of all proportion. In Mr. Dieterichs' own words: " In many cases where manufacturers are working on our area I am advised of all developments, and copies of the specification are sent to me in order that we can assist them to obtain the order for some form of gas-fired apparatus. I have always found that, although manufacturers are accused of all kinds of faults, they are always ready to accept any suggestion which may improve their appliances." This is the spirit which all undertakings should engender. The Centres must help the manufacturer and give him the benefit of the development work carried out—work which the manufacturers are not in a position to undertake. The numerous examples given in the paper of the success which has attended such development work at the G.L.C. Centre make good reading and should provide encouragement to the whole Industry.

Work for the B.G.F.

It is with considerable interest that we note a section headed " Exhibitions " in the press report of the Dec. 11 meeting of the National Gas Council Central Executive Board. Reference to later columns of this issue will show that several proposals have been considered by the Joint Co-ordinating Committee with regard to the participation of the Gas Industry in exhibitions throughout the country. It was decided, as this is a matter in which all the National Bodies are concerned, that it should be referred to the British Gas Federation, with a request that it shall set up a Committee to deal with the matter.

As far as we are aware this is the first " job of work " with which the Federation has been asked to deal since its inauguration last month, and it seems a very happy thought that the exhibition question should be referred to it. It is no secret that the views of the Gas Industry on the question of participation in next year's B.I.F. were by no means unanimous when the subject was under discussion earlier this year, and, while it was generally conceded that the plant and appliance manufacturers were faced with a great difficulty in the transfer of the date from February to May, there were many others who regretted the non-participation of the Industry in this national event. The fact that the direct cost of exhibiting falls on this section of the Industry entitles them to at any rate a big say in the matter, and we believe the Federation, on which the Society of British Industries has full representation, will be excellent common ground upon which to discuss all aspects of it. We think, also, that some scheme may be evolved from joint discussion capable of showing a better return for expenditure as far as the Gas Industry is concerned than the B.I.F., the primary object of which is, after all, avowedly to stimulate export trade.

In welcoming the formation of the B.G.F., the Chairman of the S.B.G.I. at the Annual Meeting last month remarked that the Society was an entity which had its own peculiar point of view, and it was just as necessary for the rest of the Industry to respect that point of view as it was for the Society to appreciate the point of view of the rest of the Industry. Here seems an admirable opportunity for an exchange of views on these viewpoints which we hope will leave the Industry unanimous upon what has tended at times to become a sore point.

"Elementary Electricity"

Quite recently we came across in the newspaper Press an old horse, with possibly a new tail, in the form of a question as to " Why is not elementary electricity more commonly taught in girls' schools? " It would certainly be a good thing for electricity—if not for the girls—which fact has long been recognized by those engaged in the sister industry. For our part, we should hesitate to fix any age at which it would be too soon to introduce schoolgirls to our own Industry—we need not specify the branch of study as being " elementary gas," an advantage which we have over our competitors. This schoolgirl training is a matter that the electricians must not be allowed to get away with; the housewives of the future should be enabled to start upon their careers with a fair knowledge of the most popular method of cooking, if cooking at all is to be taught them.

The " new tail " is the suggestion that electricity should be taught in girls' schools because, " with the rapid growth of the grid system, every housewife should know, at least, how to mend a fuse or replace a lamp flex. The average husband is apt jealously to keep these secrets to himself." Clearly, schoolgirls should be guarded against the machinations of the wily husband, but would it be worth while to occupy the time of girls while at school on little matters of this kind, were there not in the background the prospect of thus making the pupils " electricity minded? " Anyway, if it is wise to initiate schoolgirls into the mysteries of the fuse and lamp flex, it must be even more desirable that they should learn about the efficient gas apparatus that will be at their command in later life.

The Christmas Spirit

All around us we see indications of the near approach of Christmas; the " Christmas Spirit " is abroad. Our eyes are assailed by pictures of snow scenes and of people muffled up to the ears to keep out the cold, while we have been walking about in our least substantial clothing, sighing for that gas fire load by which we should be overwhelmed were the weather conditions anything like those that, for this season of the year, the artist so dearly loves to depict. Signs of affability are discernible in unusual directions; and there is a tendency for an atmosphere of " give " to displace the atmosphere of " take " which is more prevalent during other periods of the year. Strangers with whom we come in contact exercise upon us rather a " thawing " than a " freezing " influence. Humble atoms of the community, perchance, find themselves the subjects of courtesy to which they are not invariably accustomed. How welcome is the Christmas Spirit. Peace and goodwill!

But why confine it to Christmas? Now that the Spirit

is once again among us, is it not worth an effort to make it captive, so that it may remain with us for evermore? Think of the great gulf that is fixed between the two words "attraction" and "repulsion." After you have made your Christmas purchases, devote a few minutes to reviewing the impresssions left upon your mind by the shops or stores visited. It is unlikely that the "impression graph" will be a straight line. Some of the places you would doubtless rather re-visit than others, and, this being the case, it is because in the pleasant spots you have encountered the real salesman or saleswoman, and not the person who, having produced two or three articles for your selection, is inclined to drum with his (or her) fingers on the counter, and look away towards the window, while you are making your choice. This is not a picture torn from the imagination, but merely the reflection of a place into which the Christmas Spirit has not entered.

All manner of things have been said and written for the guidance of the salesman and saleswoman, so that there would seem to be little more in the way of advice to offer them; but the moment does afford an opportunity to point to the immeasurable value of goodwill in business, and to plead the cause of a permanent "Christmas Spirit" in all transactions with one's fellows.

Road Tar and Livestock

THE case of Thompson *v.* the Leicestershire County Council which was reported in our columns last week is of considerable interest in view of the allegations, now fortunately much less frequently heard than of yore, that the use of tar on highways in rural areas is likely to cause harm to cattle.

The facts of the case were, briefly, that a pond for many years used as a drinking place by cattle was fed with surface water from a road known as Enderby Lane. The road was formerly water-bound, but in June, 1929, it was sprayed with tar stated to contain 4% of phenols or crude tar acids. In September, 1930, the road was re-dressed with tar which was stated to contain 2·8% of phenols. Between January and March, 1930, one bull and seven cows—the property of Mr. Thompson—died under somewhat mysterious circumstances. All the animals had had access to the pond, and it was alleged by Mr. Thompson that in each case death was due to the fact that the water of the pond had been polluted by tar. The case was referred to a retired County Court Judge sitting as arbitrator.

At the hearing the Highway Authority called the attention of the arbitrator to the importance of the case, affecting as it did a vast mileage of tar-sprayed roads throughout the country. Having regard to this fact, all intention to rely upon legal grounds of defence was disclaimed, the defendants being content to abide by the simple decision of fact as to whether the death of the cattle was due to tar poisoning. The strongest evidence which could be called by Mr. Thompson on this point was that a post-mortem examination had shown that the bladder of one of the cows yielded 0·08% of phenols. It was, however, elicited from a veterinary surgeon in cross-examination that so low a proportion as 0·08% of phenols might be expected in the normal urine of a cow.

The hearing of the case lasted four days, during which every aspect of the question was considered in detail. The arbitrator gave his decision in writing, and held that the cattle did not die as the result of tar poisoning, or of any washings from the road, and that the tar employed did not contain poisonous or deleterious ingredients injurious to cattle. We suggest that the Gas Industry should lose no opportunity of calling the attention of Highway Authorities to the decision of the arbitrator in this case. The advantages of tar as a road surfacing material have for long been appreciated and enjoyed by the motoring community, and it is good to know that these advantages can be enjoyed without detriment to an equally important section of the community.

Correspondence

Crude and Concentrated Ammonia Liquor

SIR,—I must thank Mr. Parrish for pointing out the difference between crude concentrated ammonia liquor and concentrated gas liquor. The mistake, I think he will agree, is one that could easily arise to the uninitiated.

I must explain that the word crude is intended to convey the fact that impurities are present and concentrated ammonia has been used to explain that the ammonia present has been concentrated to a smaller bulk. After all, the use of the word ammonia in the product should not offend but rather reassure the purchaser that there is some NH_3 in his concentrated gas liquor. In my view, the word "crude" is far more explanatory when referring to this effluent than the word "liquor," which undoubtedly has several meanings.

At any rate I feel that we are both agreed that 20% to 22% concentrated gas liquor can be transported at the same rates as 15% to 18%.

Yours, &c.,
T. O. WILTON.

Charing Hersham Road,
Walton-on-Thames,
Dec. 11, 1934.

Forthcoming Engagements

January.

3.—MIDLAND JUNIOR ASSOCIATION.—Meeting at Nottingham and paper by Mr. W. L. Howe.
12.—SCOTTISH JUNIOR GAS ASSOCIATION.—Joint Meeting at Glasgow. Paper by Mr. Stephen Lacey, of London.
19.—WALES AND MONMOUTHSHIRE JUNIOR ASSOCIATION.—Meeting at Porthcawl. Paper by Mr. G. Thomas.
19.—YORKSHIRE JUNIOR ASSOCIATION.—Meeting at Sheffield. Paper by Dr. Fritz Gummert (Director of the Ruhr Gas Company).
23.—B.C.G.A.—Manchester District Meeting, Manchester.
24.—B.C.G.A.—Yorkshire District Meeting, Leeds.
25.—B.C.G.A.—Northern District Meeting, Newcastle-on-Tyne.
25.—LONDON AND SOUTHERN JUNIOR ASSOCIATION.—Meeting and paper by Mr. S. F. Dunkley.
26.—WESTERN JUNIOR ASSOCIATION. — Visit to Gloucester.
31.—B.C.G.A.—South-Western District Meeting, Exeter.

February.

6.—MANCHESTER AND DISTRICT JUNIOR ASSOCIATION.—Visit to Stretford. Paper by Mr. W. Hodkinson.
7.—B.C.G.A.—Eastern District Meeting, Cambridge.
7.—MIDLAND JUNIOR ASSOCIATION.—Meeting and paper by Mr. F. H. Lesley.
9.—WESTERN JUNIOR ASSOCIATION. — Meeting at Bridgwater.
9.—SCOTTISH JUNIOR ASSOCIATION (EASTERN DISTRICT). Visit to Leven. Paper by Mr. C. L. W. Berglin.
9.—SCOTTISH JUNIOR ASSOCIATION (WESTERN DISTRICT).—Meeting and paper by Mr. T. R. Sawers.
14.—B.C.G.A.—Midland District Meeting, Birmingham.
15.—LONDON AND SOUTHERN JUNIOR ASSOCIATION.—Meeting and paper by Mr. P. F. Scarth.
16.—WALES AND MONMOUTHSHIRE JUNIOR ASSOCIATION. Meeting at Port Talbot. Paper by Mr. West.
16.—YORKSHIRE JUNIOR ASSOCIATION.—Meeting at Barnsley. Papers by Messrs. V. J. J. Siddons, R. H. McCulloch, and A. Pickard.
21.—B.C.G.A.—South Wales District Meeting at Cardiff.

PERSONAL

NEW INSTITUTION APPOINTMENT.

Mr. Walter T. K. Braunholtz, M.A., Ph.D. (Cantab.), F.I.C., who is 39 years of age, was educated at Greshams School, Holt, and Trinity College, Cambridge. After taking a First-Class Honours Degree in Science, he was engaged in chemical research at Cambridge University for a period of two-and-a-half years under Prof. Sir William Pope, F.R.S., and Dr. W. H. Mills, F.R.S., and he also carried out research for one year at the Federal Technical College, Zurich, under Prof. H. Staudinger. As a result of these investigations he was awarded the degree of Ph.D. at Cambridge. He left Cambridge to join the staff of Pease & Partners, Ltd., Darlington, as Chemist-in-Charge of laboratories and research work in connection with a group of collieries and coke oven plants in County Durham.

When the Northern Coke Research Committee was instituted in 1926, Dr. Braunholtz was appointed their Senior Chemist and with a staff of assistants, carried out for over two years researches relating to the production and utilization of coke, and to the process of coal carbonization in general. Throughout this time he was in the closest touch with the fuel industries and with other fuel research organizations.

Dr. Braunholtz returned to Pease & Partners, Ltd., at their invitation, in 1929, and has been from that time in charge of all research activities connected with the firm's collieries, carbonizing plants, and chemical works. He has actively participated in the work of the Northern Section of the Society of Chemical Industry, Coke Oven Managers' Association, and a number of other scientific and technical bodies. He is an accomplished linguist, and has produced both translations and reviews of various French and German scientific works. He has also published (alone and in collaboration) numerous papers in scientific journals.

During the Great War Dr. Braunholtz served with the Royal Engineers, and was also, for a considerable time, engaged in research and process control at a large explosives factory in the North.

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Mr. ATHOL BROWN, Technical Assistant to the Buckhaven and Leven Gas Commissioners, has received the premier award of the Society of British Gas Industries for his Paper in the Minor Course in Gas Supply of the City and Guilds of London Institute Examinations. He has also received the Guilds Silver Medal.

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Mr. J. P. THOMSON, of Alva, has been appointed Manager of the Eyemouth Gas Company. He previously held appointments at Troon and Alva.

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Mr. ROBERT FIFE, who has been appointed Engineer and Manager of the Kilmarnock Gas Department, is a native of Beith. He began his career as an apprentice chemist with Messrs. Glenfield and Kennedy, Engineers, Kilmarnock, qualifying in chemical engineering subjects at the Glasgow Technical College. In 1917 he became Works Chemist in the Kilmarnock Gas Undertaking. Mr. Fife is an Associate Member of the Institution of Gas Engineers and in 1928 was President of the Scottish Junior Gas Association (Western District). During the 1927 session he was awarded first prize for the best Paper on any subject connected with gas production.

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Mr. SYDNEY SMITH, who is President of the Scottish Junior Gas Association, Eastern District, and who for some years was Assistant Engineer and Manager of Dunfermline Corporation Gas-Works, has been appointed Deputy Engineer and Works Manager to the Bristol Gas Company.

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Mr. J. R. W. ALEXANDER, Secretary of the Institution of Gas Engineers, has been unanimously elected a Governor of Ardingly College in the Southern Division of the Corporation of SS. Mary and Nicolas. Our readers will be interested to know that Mr. Alexander has also been unanimously elected a member of the Scientific Secretaries' Society, the membership of which is restricted to twenty-five.

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Mr. DOUGLAS RHODEN, formerly with Messrs. Alder & Mackay, has joined the sales staff of Messrs. George Wilson Gas Meters, Ltd., and will operate in the Yorkshire area in association with Mr. W. R. GILL from Messrs. Wilson's new Leeds office at 7, New Station Street, Leeds.

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We regret to learn that the wife of Mr. LEWIS SHAW, Manager of the Rothwell Gas Light Company, was taken hurriedly to a Leeds nursing home on Dec. 8 for an immediate operation to her hand. Though recovery will of necessity be slow, it is understood that she is progressing as favourably as can be expected, and there are hopes that she will not lose her hand, as was at first feared.

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At St. Mary's Church, Whitkirk, Leeds, Miss MAISIE GOODALL, only daughter of Mr. and Mrs. C. A. Goodall, of The Avenue, Halton, Leeds, was married on Dec. 12 to Mr. Henry Geoffrey Duckett, second son of Mr. and Mrs. F. W. Duckett, of Hyde Park, Leeds. The bride's father is a member of Leeds City Council, and, of course, Managing Director of Messrs. Goodall, Clayton, & Co., Ltd., the well-known firm of Engineers and Contractors.

Obituary

FRANK C. TAYLOR.

His many friends in the Industry will learn with regret of the death on Monday of Mr. FRANK C. TAYLOR, for many years Engineer, Manager, and Secretary of the Shanklin Gas Company.

Born in 1855 at Twyning, near Tewkesbury, Mr. Taylor was educated at the Abbey School, Tewkesbury, and was apprenticed in 1869 to Messrs. Collins & Cullis, cathedral and church builders. After continuing with this firm for two or three years following the completion of his apprenticeship, he removed to Bath, and succeeded to a position in the distribution department of the Bath Gas Light Company. Mr. Taylor's association with Shanklin dates back to the year 1881. In the year following his appointment Mr. Taylor was elected a member of the Gas Institute. It was upon the death of Mr. W. Sutherland, the Secretary, in 1892, that he was appointed to the dual office of Secretary and Manager, and there has been uninterrupted progress in every department of the Company's operations ever since. Mr. Taylor was a member of the Southern Association of Gas Engineers and Managers. He was held in high esteem by the Directors and staff of the Shanklin Company generally, and on the completion of his half-century of service with the Company he was made the recipient of a chiming clock by the employees, and a divan chair by the Directors.

Reference to the "JOURNAL" for Aug. 30 of last year will give our readers some idea of the great work Mr. Taylor has done for the Gas Industry in the Isle of Wight. His only son, Mr. Fred W. Taylor, is Engineer and Secretary of the Ryde Gas Light Company.

The funeral takes place at 2.15 p.m. to-morrow (Thursday) at St. Saviour's-on-the-Cliff, Shanklin.

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The death is announced of Mr. Jeffrey Hardman, Chairman of Messrs. E. Hardman, Son, & Co., Ltd., Hull, who passed away on Dec. 16, in his 72nd year.

News In Brief

Price Reduction.—Clonmel Corporation has reduced the price of gas by 6d. per 1,000 c.ft. to 4s. 7½d., as compared with 4s. 9d. in the pre-War days.

Following the Exhibition at Tutbury, the Burton-on-Trent Gas Department have arranged further exhibitions at Barton-under-Needwood and Alrewas.

An Extension of Mains in new housing estates in the Borough, at an estimated cost of £982, is to be undertaken by the West Bromwich Gas Department.

Applications are Invited for the position of Assistant Engineer and Manager to the Dunfermline Gas Department at a commencing salary of £300 per annum.

A Lady Superintendent is required by the South Metropolitan Gas Company, particulars of which appointment may be obtained from the Secretary of the Company.

The New Showrooms of the Tottenham and District Gas Company in Fore Street, Hertford, were opened on Tuesday, Dec. 18, by the Mayor of Hertford (Councillor J. F. Keeble).

The Offer of Messrs. Woodall-Duckham Company, Ltd., London, for repairs to retort bench No. 2 at the Dawsholm Gas-Works, has been accepted by the Glasgow Corporation Gas Committee.

An Exhibition of gas appliances was opened in Grangemouth on Dec. 10 by Dean of Guild Peddie. Cookery demonstrations were given by Miss Curd. The exhibition closed on Dec. 15.

The Output at Largs is steadily increasing and during the month of November 4,552,700 c.ft. were manufactured, which is an increase of 339,900 c.ft. over the figure for the same period last year.

A Board of Trade Inquiry will be held at Andover on Dec. 21 into an application by the Andover Lighting and Power Company for a Special Order under the Gas Undertakings Acts, 1920 to 1934.

The Tender submitted by Messrs. West's Gas Improvement Company, Manchester, for the extension of vertical retort plant has been accepted by the Buckhaven and Leven Gas Commissioners.

The Leipzig Spring Fair, 1935, will be held from Sunday, March 3, till Sunday, March 10. Inquiries for the reservation of fair stands are being received in considerably larger numbers than in previous years.

Applications are Invited for the post of Assistant Engineer and Manager to the Macclesfield Corporation Gas Department. The appointment carries a commencing salary of £250 per annum rising by annual increments of £10 to £330.

Change of Calorific Value.—The Uckfield Gas and Electricity Company give notice that, as from the readings of the meters for the quarter ended March 25, the calorific value of the gas supplied by them will be reduced from 500 B.Th.U. to 475 B.Th.U.

Recent Price Reductions include Millport from 5s. to 4s. 2d. per 1,000 c.ft. for ordinary, and from 5s. 5d. to 4s. 7d. for prepayment, consumers, and Newtown who now charge 1s. per therm up to 40 therms, with a sliding scale for quantities in excess of that amount.

To Extend their Plant the Portsmouth Gas Company are applying to the Board of Trade for a Special Order which will empower them to do so. The Order will vary or extinguish all rights and privileges which would impede or interfere with its purposes and confer other rights and privileges.

Neath Strike Over.—We learn that after a settlement had been reached in the dispute concerning a wages claim at the Neath Corporation Gas-Works, the stokers and labourers returned to work for the night shift on Wednesday, Dec. 12. The volunteer staff mentioned last week were successful in maintaining a good supply throughout.

A Protest is to be Lodged by a majority of housewives in Buckhaven and Methil whose prepayment meters are being altered by the Buckhaven and Leven Gas Commissioners. In some cases, it is understood, the workmen have been refused access to the houses. At present 120 c.ft. is given for 1s., with a discount of 10s. in the £; but the meters are to be altered to give 180 c.ft. for 1s., with 5s. discount in the £. The objectors state that they have purchased gas appliances on the instalment system and have depended on the discount to pay for them.

Further Powers are sought by the Steyning Gas Company, Ltd., in a Special Order for which they intend to make application to the Board of Trade. One of the purposes of the Order is to enable the Company to offer shares for subscription by employees of the Company and to consumers of gas supplied by the Company without first offering the same for sale by public auction or tender.

Copies of the Following recently published British Standards Specifications may be obtained, price 2s. each, from the Secretary of the Institution of Gas Engineers, 28, Grosvenor Gardens, S.W. 1: No. 324-1934.—Translucent (Diffusing) Glassware Illumination Fittings for Interior Lighting (Superseding No. 324-1928) and No. 364-1934.—Neck and Flange Dimensions of Illumination Glassware and Carriers (Superseding No. 364-1929).

An Extension of Limits is one of the purposes of a Special Order for which the Kettering Gas Company intend to make application to the Board of Trade. Other objects of the Order include the prohibition of the Rothwell Urban District Council from exercising within the added limits any of the powers conferred on them in respect of the supply of gas and to define the price which may be charged by the Company for gas within the added limits.

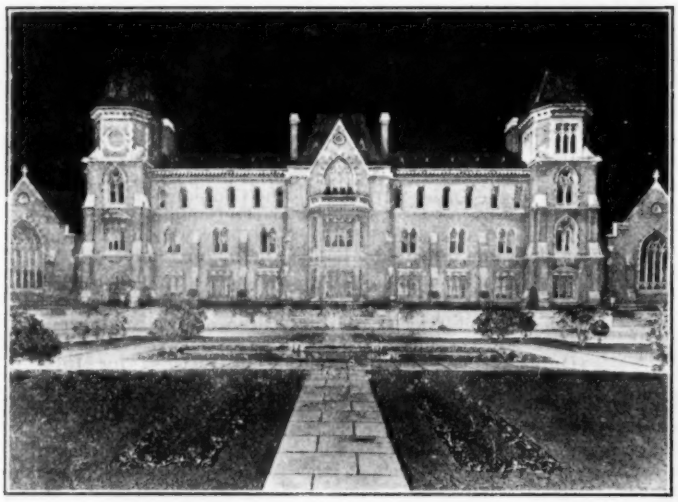
Gas Meter Company Advertises Gas.—Messrs. George Wilson Gas Meters, Ltd., have carried out an original idea to advertise gas. Everyone of their lorries has a gas slogan prominently displayed on each side. The first slogan to be used is "Gas—To Be Sure," and periodically these will be changed. Thus, as these lorries deliver meters in all parts of the country, travelling through many towns, a very valuable advertisement for the Gas Industry is obtained.

The First Series of cookery demonstrations in the Redditch Gas Company's new Demonstration Hall were concluded on Friday evening, Dec. 7. The record attendances gave evidence of the great popularity of gas for cooking, and the Company's Demonstrator, Miss C. P. Hill, C.D.S., Y.T.C.H. (late of Radiation, Ltd.), carried out a varied programme of Christmas Cookery which highly delighted her audiences. A number of competitions were arranged which contributed to the great success of the Demonstrations.

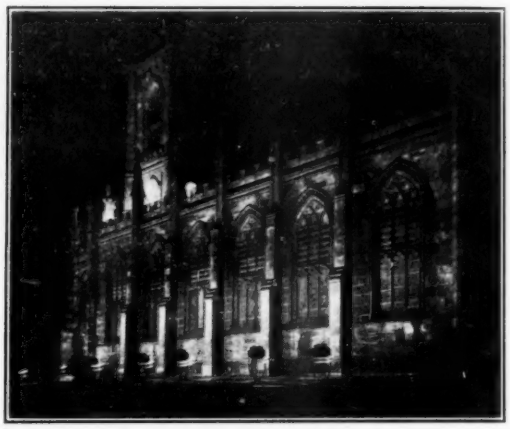
Successful Cookery Demonstrations were recently held at the Baths, Newport (Mon.). Miss M. Jack, Cordon Bleu Silver Medal, N.T.C., showed enthusiastic audiences how to prepare luncheon and tea-time fare, supper dishes, and other delicacies by gas cooking. In connection with the demonstrations special prizes were offered in a home-baking competition, and, as a result of a special display of modern gas appliances, a good deal of business is expected to materialize. The Newport (Mon.) Gas Company arranged this demonstration in conjunction with Messrs. Brown & Polson, and the attendances reflected the success of the venture, there being as many as three hundred at one session.

The Success that has attended the Melbourne Gas Congress which was held recently in connection with the Victorian Centenary was so pronounced, we are informed by Messrs. William Coward & Co., Ltd., 3, St. James's Square, S.W. 1, that it is probable that further similar meetings might well be arranged for yearly. Five Papers were read during the Congress. These included one from Sir Francis Goodenough (see "JOURNAL" for Nov. 14), two from Members of the America Gas Association, one from Mr. A. Hewitt, of Toronto, and one from the Wellington Gas Company, New Zealand. There can be no doubt that the Congress will prove to be a landmark in the history of the Australian Gas Industry.

Edinburgh Gas Sales Up.—At a Meeting of the Gas Sub-Committee of Edinburgh Public Utilities Committee, held on Dec. 14, the Engineer and Manager, Mr. J. Jamieson, in submitting his monthly report to Nov. 15, pointed out that the gas sent out was 372 million c.ft. as compared with 354 million c.ft. for the same period last year, representing an increase of over 5%. From May 16 to Oct. 15 the amount of gas sold was 1,622 million c.ft. as against 1,553 million for the same period of last year, an increase of 4·43%. When it is recollected that for the same period in 1933 there was an increase of 5·34% these figures give an indication of the continued and satisfactory progress which the Department is making. The numbers of cookers on free loan was up by 153, on hire by 212, and on hire-purchase by 1,404, and it was mentioned that the Department had sold over 2,000 heating and other apparatus.



FURTHER FINE EXAMPLES OF GAS FLOODLIGHTING CELEBRATE ROYAL WEDDING



As gestures of rejoicing at the recent Royal Wedding, the accompanying two fine examples of floodlighting were carried out by gas. Above is Woodall House, the Chief Office of the Tottenham and District Gas Company, while on the right is the Oldham Parish Church, also beautifully outlined against the night sky.

National Gas Council.

Meeting of Central Executive Board.

A meeting of the Central Executive Board of the National Gas Council was held at 28, Grosvenor Gardens, S.W. 1, on Tuesday, Dec. 11, at 11 a.m.— Sir DAVID MILNE-WATSON, LL.D., D.L., in the Chair.

Parliamentary.

Industrial Re-organization (Enabling) Bill (House of Lords).

It was reported that this Bill, which is a Private Member's Bill, was introduced in the House of Lord by Lord Melchett. The object of the Bill is:

> To provide for the self-government of industries by enabling the majority of producers in an industry, notwithstanding the opposition of a small minority, to introduce and cause to be enforced schemes for the reorganization of the whole or part of that industry with the general object of promoting greater efficiency, eliminating wasteful competition, and of facilitating the production, manufacture, and supply of the products of that industry.

Report from the Joint Co-ordinating Committee Meeting held on Tuesday, Dec. 4, 1934.

(a) Public Lighting Departmental Committee appointed by the Minister of Transport.

It was reported that the Sub-Committee which had been appointed by the Joint Co-ordinating Committee had approved a letter which had been addressed to the Secretary of the Departmental Committee on Nov. 19. The Departmental Committee were holding a further meeting this week, and oral evidence would be heard in Wednesday, Dec. 19.

Exhibitions.

It was reported that several proposals had been considered by the Joint Co-ordinating Committee with regard to the participation of the Gas Industry at exhibitions throughout the country. It was finally decided, as this was a matter in which all the National Bodies were concerned, that it should be referred to the British Gas Federation with a request that they should set up a Committee to deal with the matter.

Federation of British Industries.

Mr. Chas. F. Botley and Mr. Thos. Hardie were reappointed as representatives of the National Gas Council on the Grand Council, Main Group 9, Section 1 (Chemical Fertilizers and Explosives); Sir Francis Goodenough, Mr. H. C. Smith (Tottenham), and Mr. L. E. Clift were reappointed as representatives of the National Gas Council on the Grand Council, Main Group 14, Sub-Group 3 (Public Utilities).

Visit of the President to the Scottish District Executive Board at Glasgow on Tuesday, Nov. 27.

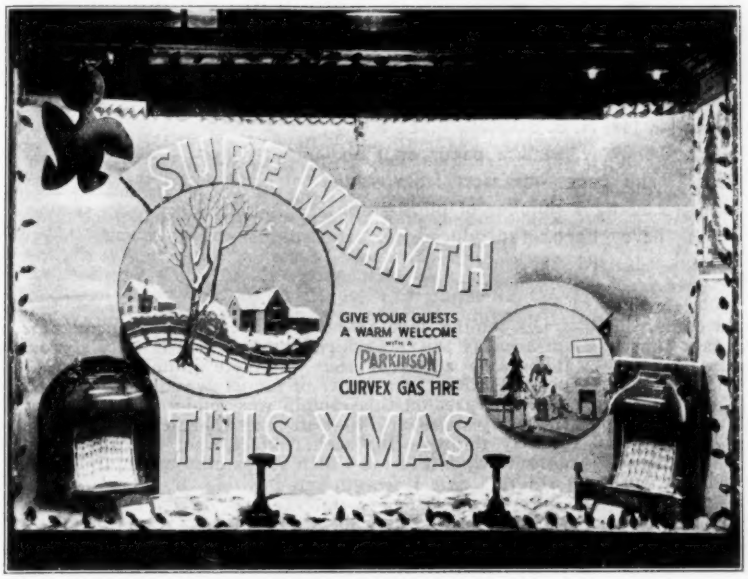
The Chairman reported the proceedings on the occasion of his visit to Scotland on Nov. 27 for the purpose of discussing the possibility of Scotland dealing with purely Scottish affairs. The Board approved the report presented by the President, and it was decided to postpone further consideration of the matter until a report had been received from the Scottish District Executive Board.

An Estimated Consumption of 10 million c.ft. of gas per annum for furnace work is that of one new industrial consumer in the area of the Motherwell and Wishaw Gas Department. The Gas Department are laying a 6-in. main at a cost of £240, together with high-capacity meter, to meet this new load, and will supply the gas at special industrial rates.

Oil from Empire Minerals.—We learn that the South African Torbanite Mining and Refining Company has placed a first order with the British firm, Salermo, Ltd., London for two complete units capable of treating 150 tons of torbanite per day for the production of oil. The contractors for the plant are Messrs. Robert Dempster & Sons, Ltd., of Elland.

Gas Wins the Day.—The Newton-in-Makerfield Urban District Council recently instructed both their Gas and Electrical Engineers to light and tender for a test section of road. After inspection the Council decided to adopt gas for street lighting on their Housing Estate. Mr. F. C. Sylvester, Engineer and Manager of the Gas Department, was also congratulated on the general improvement in the lighting of the whole district.

Cochranes (Middlesbro') Foundry, Ltd.—The centrifugal pipe-making plant at Middlesbrough-on-Tees has during the past few years been engaged on making spun iron pipes under Licence of the patented Mairy Process. Due largely to the increasing demand for the Company's products for export, it has been decided to put down a new plant, which will embrace six further centrifugal machines, and which will be operated under the same patented process. It is hoped to have these extensions completed within six months.



SEASONAL DISPLAY AT BIRMINGHAM

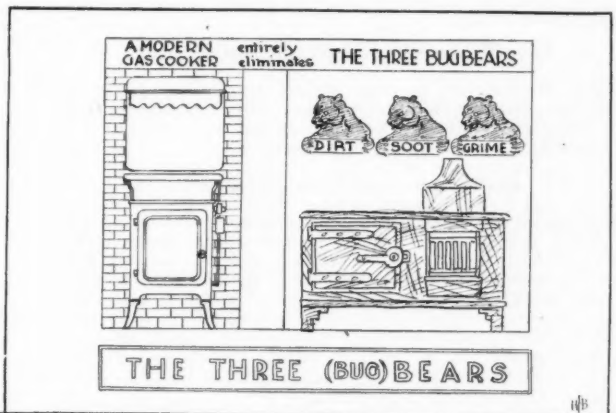
One of several attractive Christmas window displays in their showrooms, this seasonal layout has been arranged by the Birmingham Gas Department.

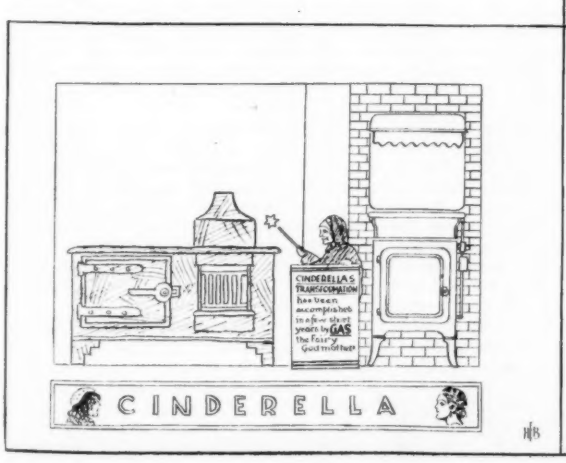
A Strange Accident

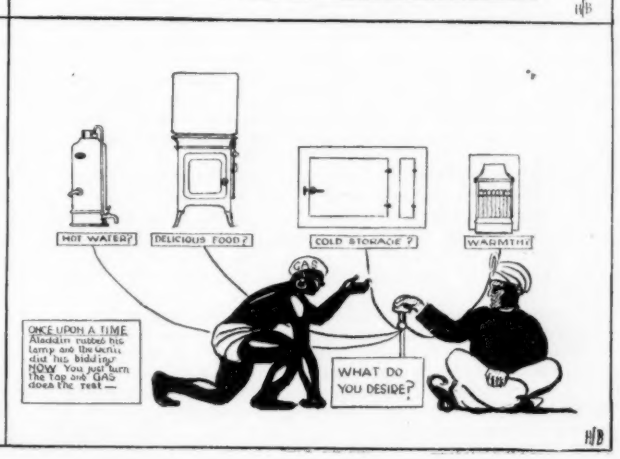
It is difficult to imagine a more unfortunate way of demolishing a lighted gas standard than by ramming it with a motor-driven tanker containing about 1,500 gallons of petrol. This, however, is what happened late on a recent afternoon in a busy shopping centre at Leamington, when a tanker skidded on a greasy road and the front part crashed into the base of a standard, which became wedged between the front off-side wheel and the body of the vehicle. The standard was bent almost to ground level and gas escaping from the pipe lower down became ignited. By the presence of mind of the driver and a police constable the fire was promptly extinguished, and no one was injured in what might have been a most unfortunate occurrence. It took about four hours to extricate the vehicle, during which time, for safety's sake, the gas was shut off in the separate high-pressure main supplying the chief public lighting in the district. Fortunately, however, the high-pressure lighting is normally replaced after midnight by a separate system of low-pressure lamps, so that complete darkness was never in question.

CHRISTMAS WINDOW IDEAS

The accompanying novel ideas for Christmas Window Displays have been evolved by Mr. H. F. Burden, of the City of Chichester Gas Company. It will be observed that an original "link-up" has been made with various Pantomimes.






HOT WATER?
DELICIOUS FOOD?
COLD STORAGE?
WARMTH?
GAS
ONCE UPON A TIME Aladdin rubbed his lamp and the Genii did his bidding NOW You just turn the Tap and GAS does the rest —
WHAT DO YOU DESIRE?

Floodlighting by Gas

by H. E. BLOOR

At a meeting of the Illuminating Engineering Society on Tuesday, Dec. 11, Mr. H. E. BLOOR, B.Sc., B.Eng., of the York Gas Company, read a paper on Floodlighting by Gas. The paper—extracts from which follow—was illustrated by a number of photographs, many of which have been reproduced in the "JOURNAL."

That a public demand for floodlighting would come, the writer has never entertained any doubt. The fact that a few years have sufficed to ensure the inclusion of floodlighting in any scheme of illuminations is evidence that already the public mind is being formed in the direction indicated.

With such a view of the future, the writer set on foot experiments to determine whether, and to what extent, gas could contribute to the development of floodlighting as a recognized public need.

There were at that time no gas lamps on the market for the purpose, and manufacturers had not grasped the possibilities of the art.

Fortunately the management of the Gas Light and Coke Company had been thinking along the same lines, and decided to provide gas floodlighting of some of the beauties of St. James's Park, as their contribution to the illuminations during the visit of the International Illuminating Congress in 1931. Only by the generosity of this great Company, in placing its resources at his disposal, was it possible for the writer in September, 1932, to undertake the floodlighting of the ancient ruins and floral beauties in the gardens of the Yorkshire Philosophical Society at York.

York possesses a rich heritage of ancient and beautiful buildings which lend themselves admirably to the floodlighter, on account of the grey stone of which they are constructed.

Unequal weathering of stone, causing it to present clean, bright patches, interspersed with dark discoloured areas, provides the floodlighter with certain problems, and may lead to a patchy effect which is displeasing. In certain cases a good effect as of light and shade is produced, and only by actual trial in each case can the best possible disposition of light sources and quantity of light be determined.

Floodlighting of Ancient Buildings.

As comprehended by the writer, the object is so to illuminate the subject as to reveal all its beauties while preserving or enhancing that entrancing sense of the mystery and fascination of age worn stone.

Importance of Matt Surfaces.

It may be mentioned that matt surfaces are required if an object is to be caused to stand out under strong light. Smooth polished surfaces reflect strong light into the eye of the observer, and strengthening the source of light merely accentuates this effect, which in some instances under the writer's observation is of blinding intensity. Matt surfaces stand out more boldly with every increase in illumination, but without revealing the source of light by the formation of an image—an important point in some forms of commercial floodlighting.

Were floodlighting carried out under conditions of total darkness it would be found that a very low intensity of light would suffice. Such conditions are rarely or never experienced, especially in urban areas. Not merely the general light, but isolated points of bright light, affect the eye of the observer and shift the datum (as it were) from which he reckons the relative luminosity or visibility of the floodlighted object.

A firm of manufacturers of gas floodlight lamps has published data for the guidance of gas engineers, indicating that the necessary illumination on surfaces lighted varies in the ratio of 3 to 8 for poorly lighted and brightly lighted districts respectively, while the intensity varies between 1 and 10 foot-candles for light and very dark surfaces.

While unable from personal knowledge to confirm these ratios, the writer has found in practice that surrounding light conditions profoundly influence the floodlighting requirements. If in any particular case the public lighting authorities will co-operate by extinguishing or shading public lamps "in the view," it will be found that the effect is greatly enhanced.

On coming face to face with the floodlighting of such an area as the Yorkshire Philosophical Society's grounds, it became apparent that complete illumination was impossible with the number of lamps available to me at that date. Regret on this ground was rendered unnecessary on the early discovery that in such schemes unlighted areas greatly improve the scenic effect, and provide relatively dark viewpoints from which vistas may be obtained.

In this case it was found possible, by spending a little time in selecting viewpoints, to discover pictures that would otherwise be missed.

It is quite a mistake to suppose that a casual stroll round such an area will reveal all the beauties exposed to view. For this reason the writer deprecates undue shepherding of the public while viewing gardens or ancient buildings.

From the beginning the writer took the view that the minimum effective illumination should be employed for really old buildings, and he still holds this opinion, though in practice it was found necessary to compromise to some extent with that very large section of the public which seems incapable of appreciating anything but a blaze of light.

Attention should be drawn to the special needs of tree illumination. Green surfaces can absorb an enormous amount of light, and leaves of various trees differ greatly in the degree of visibility for a given illumination. The writer would commend the method of illumination of trees from inside a grove, or from the reverse side. In the former case it is possible with careful placing of projector lamps to provide vistas of great beauty within a grove of trees. No external illumination can possibly provide such beautiful views, but they are entirely unreproducible in photographs.

In certain cases, and certain conditions of the leaves, the latter are translucent and a tree illuminated from the back, with trunk and branches standing out in startling blackness, is a thing of almost breath-taking beauty and mystery.

When architectural features are to be revealed through windows, doors, or arches the writer considers that the light intensity should, in general, be considerably lower than that employed on the fascia. Special attention should be given to all such cases, for it is possible that the interior view might be such as to justify establishing it as the primary object, which object can be attained by suitable lighting.

Impressions gained by daylight are frequently misleading, and the author would rarely trust anything but actual trial under floodlighting conditions to decide on the details of a scheme.

The gas lamps employed in floodlighting are, for the most part, of the "straight line of mantles" type, with stainless steel reflectors. The light distribution from such lamps can be varied to a very marked degree by alterations in the angle of lamp and reflector. The author has found good results in uniformity and effect from the use of reflectors of the corrugated type, which tend to break up the beam and reduce the liability to form visibly bright belts in the horizontal plane.

Avoidance of spilled light is difficult when the public view is from wide angles, and in certain cases the author has employed shrubs grown in pots. These shield the eye in a less obtrusive manner than shields of iron or wood.

It should be mentioned that the floodlighting was carried out for the Philosophical Society as a commercial proposition during the visit of the British Association to York, in which city it was formed 101 years previously. Public interest was immense, and the Society secured a profit from its enterprise.

Attention has been drawn to the fact that the expert arranging the floodlighting determines the view which shall be seen. It follows that in many cases he can build up a picture, bringing into view or leaving out such objects as will assist or injure his results.

Experiments were made with special gas mantles, giving so-called "daylight" and red effects, but in neither case

was the result so pleasing to the author as the light given by normal gas light when employed on buildings.

Artificial Daylight Mantles.

It should be noted that gaslighting offers the advantage of artificial daylight effects at very small cost, the mantles employed costing little more than ordinary gas mantles. There are doubtless many cases in which this type of light will be advantageous, and it was employed with excellent results by the Gas Light and Coke Company in the lighting of flower beds in St. James's Park.

Very little expense is involved in making experiments in any instance in which artificial daylight or red light may conceivably enhance the effect. Such experiments are very interesting, and in conjunction with observation of the effects of alterations in positions, and power of the lamps employed, are very illuminating to the floodlighter.

Present Limitations.

Gas for floodlighting presents certain advantages and suffers from disabilities. Thus the large radiating surfaces of the gas mantle, relative to the light emitted, render gas light a little difficult to focus so as to throw powerful beams of light. On the other hand, the effect produced by the use of suitable reflectors is excellent for the illumination of large surfaces, when the source of light can be placed well back from the fascia.

Again, it is in practice difficult with gas lamps now available to throw beams of light in a nearly vertical direction, the source of light being placed near to, or attached to, the surface to be lighted. This latter difficulty may prove not insurmountable, but in the meantime it must be admitted that where the light must in the nature of the case be thrown sharply upwards gas lighting units are not at present available. Fortunately in most instances in the author's experience it has been found possible to place the lamps opposite the object, and so procure the advantage of a very even and soft illumination, which is very effective by reason of the fact that the angle of vision corresponds nearly with the angle of the rays of light emission.

Examination of illuminated foliage from various viewpoints strongly brings out this point; for it will frequently be found that by looking along the beam of light an effect of comparative strong illumination is observed, as compared with that from viewpoints at an angle to the beam.

The author has under experimental conditions placed lighting units as near as possible to the surface to be illuminated, and found the effect displeasing by reason of the violent differences in illumination between different areas of the floodlighted surface.

There are many examples of commercial floodlighting in which this method is the only one possible, and it is to be hoped that suitable gas lamps for the purpose may soon be available.

Is Coloured Floodlighting Desirable?

The low intensity of brightness of gas mantles also precludes their use with colour screens. The author has found that if a screen sufficiently dense to produce the colour desired is employed the illumination is insufficient. If, on the other hand, less dense screens are employed, the colour effect seems to disappear almost completely at the distance necessary with gas floodlighting.

Whether in the lighting of buildings, and more especially of old buildings, coloured effects are to be desired is a matter of taste. The public eye is undoubtedly becoming educated to demand colour, and there appears some ground for believing that the possibilities of the gas mantle as a source of tinted light have not yet been fully explored.

In the illumination of tall edifices special attention should be given to the lighting of high points.

Not infrequently the author has seen the front of a building beautifully lighted, but the effect has been completely spoiled because the high points have been in total or relative darkness.

The architect's conception may include spires, or towers, to omit which entirely is wholly to destroy the picture. Even when inadequately lighted the effect is improved, but here the floodlighter may actually improve upon the effect hoped for by the architect by making the high point the "high spot" of illumination.

The divergence of the beam and the effect of its angular incidence conspire to render the proper illumination of very high points somewhat difficult, but fairly good results can be achieved with available equipment.

Convenience of Compressed Gas.

The author would in this connection draw attention to the extraordinary mobility conferred upon gas by the employment of compressed gas in cases of temporary floodlighting. He has found that gas from cylinders, under a pressure of upwards of 80 atmospheres, may be employed without the use of costly pressure regulators.

Photographic Difficulties.

Photographs of floodlighting form interesting mementoes of the occasion, but, in the author's opinion, wholly fail to give the sort of impression received when actually seeing the display. Thinking it possible that they might look better as transparencies, he experimented and found that transmitted light did, in fact, give an effect greatly superior to ordinary photographs. In conjunction with the photographer, Mr. R. L. S. Catchside, of York, further experiments were made, and it was found that waxing the reverse side of the paper much enhanced the effect.

Finally, the method of printing on special material having a cellulose base and emulsion coated both sides, the front being "slow" coated and the back "quick" coated, was adopted. In this manner really brilliant results were secured. This material, I believe, is obtainable only from Germany.

Discussion.

Mr. R. J. Rogers (Parkinson Stove Company, Ltd.) referred to the floodlighting of the Birmingham Town Hall. That building was of the Corinthian style of architecture, and when the floodlighting of it was discussed it was decided to show the many columns in relief. The first effort was by gas, and the results were very striking, but later the electrical department carried out a scheme with the lighting units placed in front of the columns. The general view of the people in Birmingham was definitely that this was not so effective as the gas scheme.

Continuing, Mr. Rogers read some notes, as a contribution to the discussion, on behalf of Mr. W. J. Davey, Research Lighting Engineer, Messrs. W. Parkinson & Co. (Birmingham).

In the course of these comments Mr. Davey said the disadvantages and advantages of gas for floodlighting had been fairly discussed in the Paper, and he added that units were being developed to give a much greater vertical angle of throw, while the possibilities of downward projection of light from units mounted on the roofs had not been forgotten, although it was difficult to focus light from a gas mantle to throw powerful beams of light. It might be stressed, however, that for buildings, gardens, and wherever beauty rather than spectacular effect was desired, the alignment type of floodlight gas lamp had no equal. Discussing principles, Mr. Davey urged that daylight should not be simulated in floodlighting, and suggested that the flood-lit article should rather be emphasized by contrast. A searchlight effect produced by a powerful beam of light and directed upon a coloured object had a blinding effect similar to that produced by the sun's rays reflected from snow-covered ground or from the surface of a pool whose edges were in deep shadow. The darkness of the surroundings enabled a beam of comparatively low intensity to produce beautiful effects and to discover the hidden attractions of a building or a garden where a powerful beam would dazzle and spoil the appearance. It was essential to formulate flood lighting schemes preparatory to their presentation and to determine the number of units required. The actual focussing and positioning of the units must be left to the artistic discernment of the men on the spot. From the æsthetic point of view, nothing was gained by showing up and directing attention to cracks in mortar and the senile blemishes of an old ruin, in the same way that the charming wrinkles and creases of old age lost their attractiveness when viewed through a magnifying glass; nothing, also, was gained by bringing to light the ravages of insects and their nocturnal operations in the garden. Artistic effect lay in veiling these while emphasizing by contrast the architectural symmetry, and throwing into relief the natural beauty of leaf and flower.

Mr. P. Good said that the presentation of a paper on this subject from the artistic point of view was really of very great value. He recalled the difficulties that were experienced in obtaining permits to floodlight public buildings in the early attempts, but these difficulties were gradually overcome when those responsible realized that those who were wishing to carry out this work had considerable artistic sense. From the point of view of illustrations, ordinary photographs did not do justice to the effects obtained, but the transparencies exhibited by the author seemed to show better results.

Mr. J. G. Clark remarked that, while they were apt to regard lighting from the utility point of view only, it was one of the cheapest things at the disposal of mankind having regard to the pleasure which could be obtained from its use, especially in the manner indicated by the Paper. Referring to the floodlighting in St. James' Park in 1931, he said that when he and his colleagues moved the lighting units in an endeavour to improve the aspect they found themselves embarrassed by the many beautiful effects that could be obtained, and that led to the thought that floodlighting in some cases at any rate might be under some form of clockwork control so that the lamps could be switched from one aspect to another several times during an evening or from evening to evening in order to give the public the benefit of the many changes that could be made in that way. The author had rather given the impression that he did not think much of giving colour effects to such lighting, and he was inclined to agree with that view in many cases. On the other hand, from what the author had shown by placing coloured glasses behind his transparencies it rather seemed that there were cases in which the effects could be enhanced by the introduction of colour. The use of compressed gas, mentioned in the Paper, was an extremely ingenious method of carrying

out floodlighting in difficult places so far as gas supply was concerned, and it had great possibilities. He could not quite understand, however, how the author had managed to be so successful without the use of pressure regulators, and some information on that matter would be interesting.

Mr. C. A. MASTERMAN (Gas Light and Coke Company) welcomed the Paper for the reason that it drew attention to the opportunities for painting pictures by way of floodlighting effects and also for the fact that it had differentiated between two types of floodlighting—viz., that in which the lighting was merely directed at the front of a building, which often gave a patchy and inartistic effect, and the method by which background was taken into account and an entirely artistic effect produced. In other words, the light source was the brush and the light was the paint. The difference between the two could be likened to the difference between an artist's picture and a draughtsman's coloured wash drawing, and the method adopted by the author enabled a picture to be obtained out of, perhaps, quite unpromising material. The artist at least made sure that his public would view his picture from the front, but the floodlighter had people looking at his picture not only from the back but also walking about in the middle! That was a very considerable problem which it was difficult to know how to overcome. He could not quite make up his mind whether the author was or was not in favour of colour for the landscape type of floodlighting. His own view was that there were such a variety of tints in nature that to attempt to show it by colour in this way was attempting to gild the lily, and, indeed, might even vulgarize the whole thing. In the case of the St. James' Park floodlighting at the time of the International Illumination Congress, a considerable amount of time was spent in trying to make the effects both architecturally and horticulturally pleasing to the eye, and he felt a considerable degree of success was achieved.

Mr. J. E. AMES (Office of Works) also stressed the need for treating floodlighting more from the artistic than the commercial aspect, and specially to avoid patchiness. It was hoped, he said, to carry out some work on floodlighting during the coming year in connection with the celebrations of the King's accession to the Throne, and every effort would be made to render the results pleasing.

Mr. J. R. HEPPLE (Newcastle-on-Tyne) said he specially appreciated the Paper because the author had been kind enough to lend some lamps to Newcastle for two schemes there which were carried out in celebration of the marriage of the Duke of Kent and Princess Marina. In one case—a museum of modern construction with light stone-work—there was little difficulty, and it was a great success, but in another case of a church 800 years old there was some difficulty, and it was due to Mr. Bloor's lamps that a good job had been made of it. Many thousands of people visited the church to see the floodlighting, and there was a most wonderful effect inside the church due to the floodlighting outside coming through the stained glass windows. There was also a record attendance in the Museum on account of the floodlighting, some 4,500 people passing through, the number visiting the church being 3,000. An invitation had now been received to light another church in a similar manner. This was as old as the one already mentioned, and the floodlighting would go on from Dec. 24 to 31.

Mr. F. C. SMITH (Gas Light and Coke Company), while fully appreciating the manner in which the Paper had indicated the possibility of painting a picture by floodlighting, said it was essential for the technical man to be behind the scenes before the work could be accomplished. It was interesting to look at the photographs that had been shown and try to reflect on the amount of light distribution the artist wanted in order to bring about these effects. From that point of view one could visualize that projectors having this or that distribution might be very necessary, and that it would be necessary to place these projectors before the artist so that he could choose the one best suited for the particular purpose. In the case of St. James' Park, it was found that dahlias were very suitable for this form of treatment, for example. At the same time, continued Mr. Smith, it might be worth pointing out that since the St. James' Park experiment some technical advances had been made in projectors, and those available to-day were very much better from the maintenance point of view. Mirror glass reflectors had been introduced into these reflectors, which had increased their efficiency considerably.

Mr. A. CUNNINGTON said it seemed to him that they had not yet explored the whole story with regard to colour, and he was inclined to keep a very open mind on that aspect.

Mr. J. H. BURMAN commented on the wonderful flexibility of the method which the author had described and congratulated him on his excellent artistic sense in bringing out points which were not noticeable in the daylight to many people. He had been impressed with the manner in which the author had in nearly every case suppressed the foreground, always the most uninteresting portion of a view, and had brought forward those things which really make a picture.

Mr. BLOOR, replying to the discussion and expressing his appreciation of the manner in which the Paper had been received, mentioned that the Mansion House, which formed one of his illustrations, had, according to a book recently published, been lighted on the front as far back as 1839 in connection with some celebrations. Open gas flames and tubing were used, but it was described at the time as floodlighting. Speaking generally on the newer outlook on floodlighting which he had endeavoured to bring out in the Paper, he stressed the point that personal taste entered very largely into it and that introduced certain difficulties. For instance, he had certain views on the use of colour which might not be shared by others. As an example, he had seen a War Memorial coloured with three vivid colours, which did not strike him as being in good taste, but evidently the man who did it thought so. The suggestion made by Mr. Clark with regard to changing the view from time to time was well worth further consideration, and arrangements might be made to revolve the light from time to time in order to give a different aspect, because undoubtedly some very striking results could be obtained by a slight alteration of the lighting. As a matter of fact, that happened in practice now owing to the different atmospheric conditions from night to night. On the question of the pressure regulator, obviously this would be necessary if more or less permanent use were made of the cylinders of compressed gas at, say, 80 atmospheres, but it should be noted that the Paper referred to temporary use, and in such circumstances it had been found that over a few evenings or even a week the attendants in charge of the installation could regulate the pressure sufficiently by hand.

In connection with Mr. Hepple's remarks, Mr. Bloor said that in regard to church lighting he hoped to carry out some work which would be different from anything yet done—viz., floodlight from the inside so that the light would be seen through the stained glass windows from the outside, showing the windows as pictures. The effect was incredibly beautiful. Mr. Masterman had made use of a delightful remark when he spoke of romantic floodlighting, and with the right type of subject some of the effects were truly amazing.

Colour in Gas Appliances.

Supplementing his Manchester Junior Paper reported in last week's issue, we have received from Mr. W. A. Lowe, of Messrs. Donald Macpherson & Co., Ltd., some interesting observations.

Many will agree with an American authority who has lately expressed the opinion that with cookers we in this country are prone to sacrifice appearance or *appeal*, which is a definitely marketable asset, to thermal efficiency. In other words, were we more colourful, more goodwill and appreciation from gas consumers would result. To gain this appreciation should be the aim of all efficient salesmen.

Another important point in this colour question is the goodwill to be gained by helping the customer to renovate completely an existing fireplace. This can be achieved by colour finishing curbs, surrounds, fitting in sheet metal sides, and perhaps the covering of old discoloured tiles. A number of undertakings supply their fitters with small tins of air drying enamels for doing surrounds *in situ*, and in colours to match the fires. These are applied by a cheap portable spray or even by hand. They are quick drying, and the job can be done while the fitting is completed.

Does not the question suggest itself, asks Mr. Lowe, why not sell *complete* such gas fire installations instead of fires only? Again, we have the advent of the kitchen cabinet installation, which is adequately supplied with gas appliances to meet exacting kitchen requirements. These ideas suggest the opportunity of further service for the architect, surveyor, and housing scheme builder, and a further means of getting these people to lean on gas undertakings wherever anything to do with heating and cooking apparatus in colours is required.

Turning to the more practical side, Mr. Lowe stresses the paramount importance of proper cleaning of cookers before colouring, lack of a real understanding of which has been the cause of partial failure in the past, particularly with the early pioneers of coloured cookers. It is safe to say that all these pioneers, one by one, have now adopted incineration cleaning methods as the real 100% job—efficient, quick, good, simple, and not in any way messy. Cookers when cleaned by this method are capable of a coloured renovation finish on a par with vitreous enamel itself.

Another point which should be mentioned is that some undertakings have numbers of single-cased cookers, the sides and doors of which naturally get very much hotter than those of the lagged cooker, and the oxi-di-silver finish stands right up to these severe conditions. For smaller works, whose output of cookers does not justify a complete renovation and spray plant, a range of air-drying heat-resisting cooker enamels is available in self greys, browns, and oxi-di-silver. These are applied by brush, after a good cleaning, and are hardened-off by lighting the oven up for ½ to ¾ hour. While they naturally have not quite the all-round efficiency and looks of the full process, they are nevertheless a bright and cheerful improvement over the old type black, and have already given much help to numbers of smaller concerns.

The Design of Gas-Fired Water Heaters

With Special Reference to Heat Transfer

A Paper read before the London and Southern District Junior Gas Association, Nov. 23, 1934.

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(*Concluded from p. 833.*)

Effect of Reduced By-pass Efficiency.

It is of interest to see what possibilities there are of increasing overall efficiencies and overall heat transfer efficiencies. The two may be very different for a storage heater, though they are identical for a central heating unit.* Fig. 7 shows calculated values for a storage heater having the following characteristics:

Full gas rate		50 c.ft./hr.
Storage capacity		40 galls.
Heat transfer efficiency at full gas rate	=	75%
Hourly heat loss from surface	=	1,000 B.Th.U./hr.
By-pass efficiency, 60%—*i.e.*, maintenance rate	=	3·3 c.ft./hr. (500 gas)
And heating up efficiency (as normally determined	=	73%

The curve A shows the overall heat transfer efficiency assuming this to be constant at 75% whatever the gas rate. The curve B shows the overall efficiency for the same heater allowing for surface heat losses of 1,000 B.Th.U./hr. It is possible to reduce these further by the use of better or thicker lagging, but for this example it is assumed that the economic limit for lagging has been reached.

The curves C and D show the effect in practice of the reduced by-pass efficiency on the overall heat transfer efficiency and overall efficiency respectively. The curves E and E_1 show, for comparison, the overall heat transfer efficiency and overall efficiency of the same tank heated by an electric immersion heater of equivalent heat input (at 100% efficiency) for the same surface losses (the latter being independent of the mode of heating). For this storage heater, increase in by-pass efficiency up to the maximum of 75% would result in a reduced maintenance rate of 2·67 c.ft./hr. The maximum saving possible by such an increase would be 3·3 − 2·67

= 0·63 c.ft./hr.,

or with gas at 8·6d./therm, about £1 per annum. The saving will, of course, in practice be considerably less than this figure (normally 5s. to 10s. per annum), which assumes the heater to be on by-pass rate all the year. The actual saving per gallon for any usage can be calculated from the difference in the right-hand ordinates corresponding to any given usage on the curves B and D.

The general conclusion to be drawn from such considerations is that increase in by-pass efficiencies of domestic storage heaters is much less important than reduction in surface losses and is only justified if the necessary changes in design are inexpensive. Thus, if the surface losses could be reduced to half the stated value the maintenance rate, even at 60% efficiency, would be reduced to 1·65 c.ft./hr., equivalent to a maximum possible saving of about £2 12s. per annum and a probable saving of very nearly this amount, since heat losses will be occurring whether the heater is at by-pass or full rate. It should be clear that for large storage systems these savings would be magnified approximately in proportion to the gas rate required.

Fig. 8 similarly shows the variation in heat transfer and overall working efficiencies of central heating units (the two being identical) assumed to be 80% efficient at full gas rate and the efficiencies shown (70, 60, 50%) at by-pass rate. The latter is assumed to be one-tenth of the full rate. Much higher overall efficiencies are obtainable from such a

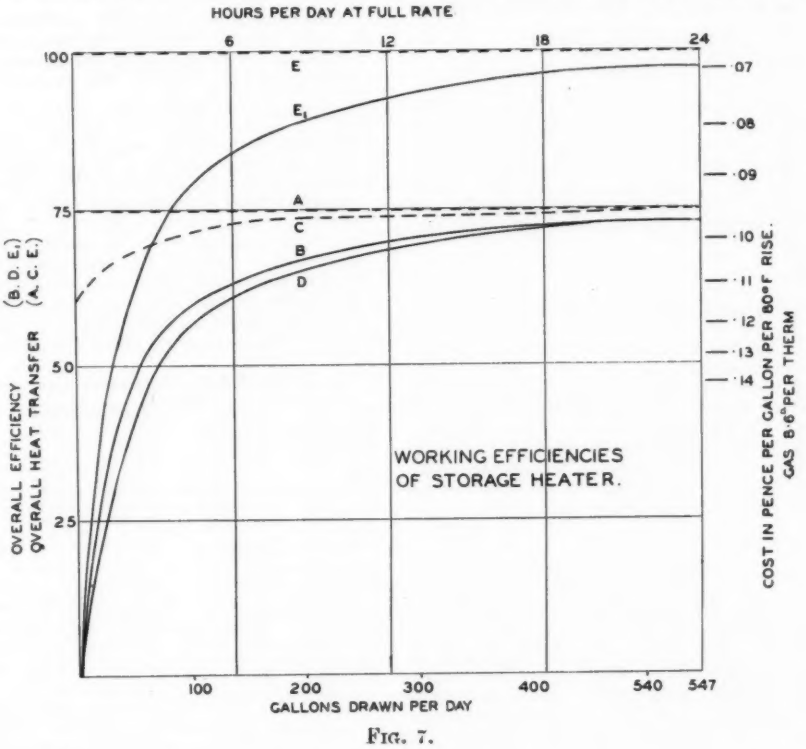

FIG. 7.

* *Cf.* extreme case where water is maintained hot, but no water is drawn. Heat losses are occurring all the time. With a central heating unit it is true that pipe losses occur—*i.e.*, heat is conveyed to portions of a building where it is not wanted. In the extreme case of this, zero efficiency would be obtained, but I am using the term overall efficiency in a rather different sense, which I trust will be clear from the text.

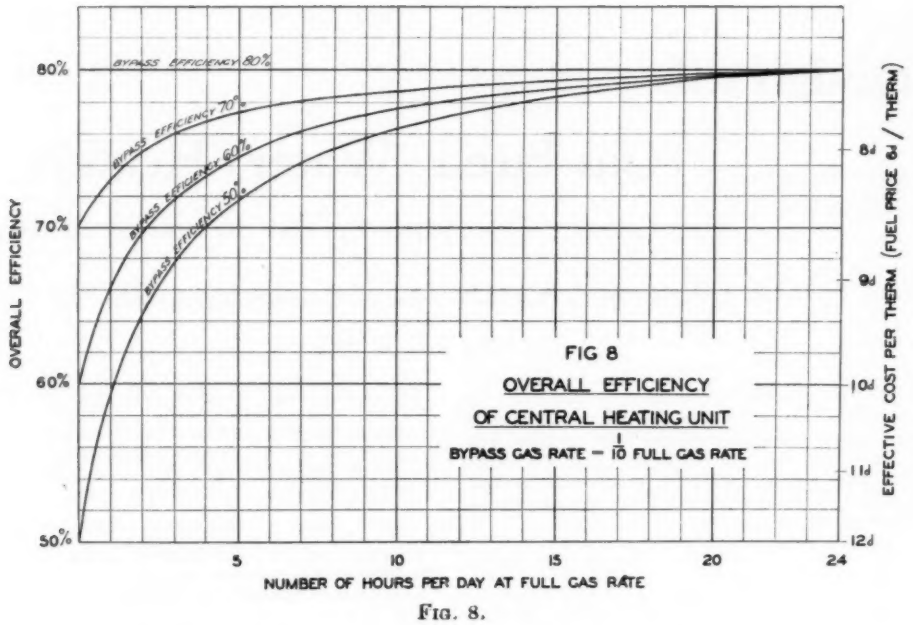

FIG. 8.

unit, but the savings resulting from an increased by-pass efficiency are very appreciable on the larger installations. For example, from fig. 8, for a unit working on an average 8 hours per day at full load, increase in the by-pass efficiency from 50% to 70% reduces the effective cost per therm

$$(i.e., \text{ nominal cost} \times \frac{100}{\text{overall boiler efficiency}})$$

by 0·18d./therm, or for a seasonal consumption of 10,000 therms (a reasonable figure for a unit of 500,000 B.Th.U./hr. output) about £10. For a unit of this size the automatic damper of the type mentioned below costs about £10, which is repaid in the first heating season by the saving in fuel costs. For smaller units the saving is proportionately less, but usually pays for the cost of the damper in the first two heating seasons.

Bottom Flue Outlet.

The method most commonly employed for improving by-pass efficiencies is the use of a bottom flue outlet for which it has been claimed that the amount of air passing through the appliance is proportional to the gas rate. This is only very approximately true, but there seems to be no doubt that a higher by-pass efficiency can be obtained with such a construction than with a top flue outlet. The increase is not necessarily large, and, in the interests of simplicity of construction, the top outlet is frequently preferred. With this type of outlet there are possibilities of securing an increased by-pass efficiency not yet fully explored—*e.g.*,

Auto Damper.

(1) The use of automatic damper operated in various ways—*e.g.*, by the gas pressure—and designed to reduce the effective flue outlet area at by-pass rate so that the CO_2 remains approximately the same as at full rate. Such dampers are hardly applicable to domestic appliances, but for central heating or indirect hot water supply units and steam boilers some types are practicable and effect valuable savings. Precautions must be taken to guard against failure of the damper to open, thereby causing smothering at full gas rate, a further complication being thus introduced. This, however, is not a serious objection when large-scale plant is being considered. Some central heating units employing forced draught may be regarded as extreme examples of this principle; practically no air passes through the flueways when the fan is not operating and only small pilots left burning. The submerged combustion method of gas heating offered a similar advantage, but so far has not met with success for other reasons.

Radiant By-pass Unit.

(2) Use of a radiant heat unit of maximum attainable efficiency at by-pass rate—heating being mainly by convection and gas radiation at full gas rate. Experiments on such a unit are in progress at Watson House.

Baffles, Flue Surfaces.

(3) The possibility of designing baffles or flue surfaces giving a greater by-pass efficiency while not reducing the combustion standard at full rate.

There are doubtless other methods that have been or will be applied. The difficulties to be overcome are considerable—but so is the potential reward in increased overall efficiency and service to the consumer.

Heat Transfer—Concluding Remarks.

It may have been noticed that I have sub-titled these notes on heat transfer "Design for Compactness" rather than "Design for Efficiency." I have already emphasized the danger of a mere uninformed striving after thermal efficiency—if, indeed, one can be said to strive for an object in itself so easy of attainment. Yet provided due attention is paid to the importance of the various other factors involved in design, high thermal efficiency will help us the better to meet our competitors. The object of the preceding notes is, however, not so much to show how to obtain a high thermal efficiency as to suggest ways of get-

TABLE III.A.—*Appliances with Smooth Surfaces and Baffling Devices.*

Appliance.	Burner.†	Area of Heating Surface (Sq. Ft.), Net.*	Area of Heating Surface (Sq.Ft.), Gross.*	Rated Output. B.Th.U./Hr.	Q Net.	Q Gross.	Flu Temp. °F.
Small storage heater A	L.F.	0·79		2,970	3,760		370
Small storage heater B	,,	1·14		4,380	3,840		360
Experimental circulator with straight baffle	,,	3·33		18,270	5,500		250
Experimental circulator (corrugated baffle No 1)	,,	3·33		20,000	6,000		218
Experimental circulator (corrugated baffle No. 2)	,,	3·33		22,000	6,600		280
Tubular C.H. unit with spiral baffle	S.B.	28·26		69,600	2,460		..
Single point geyser	L.F.	4·71		75,060	11,600		630
8 in. flat bottom pan (at "zero contents")	B.F. (contact)	0·349 (bottom)		..	15,500 (over bottom surface)		..
8 in. flat bottom pan (at "zero contents")	,,	..		..	1,186 (over sides)		..

* For appliances with smooth surfaces net and gross values are identical—the latter being defined as the area of heating surface including the surface area of any projections (fins, pips, &c.).

† L.F. = luminous flames. B.F. = Bunsen flame. S.B. = semi-bunsen flame.

ting a good thermal efficiency by the simplest possible means and in the smallest practicable space. The problem of producing a water heater which for a given service shall be more compact than its predecessors resolves itself into that of obtaining a more intense heat transfer without introducing various possible attendant disadvantages. Table III. is of some interest in this respect; it shows the measured overall heat transmission Q, expressed in B.Th.U./sq. ft. of heating surface per hour, for various typical appliances together with the corresponding gross and net heating areas, rated output, and outlet flue temperatures.

TABLE III.B.—*Appliances with Projections on Heat Transfer Surface*

Appliance.	Burner.	Heating Surface. Net Sq. Ft.	Heating Surface. Gross Sq. Ft.	Rated Output. B.Th.U./ Hr.	B.Th.U./Sq. Ft./Hr.		Flue Temp °F.
					Net.	Gross.	
Central heating unit with pips .	L.F.	8·66	c.11·55	34,100	3,940	2,950	300
Central heating unit with fins .	B.F. (no contact)	22·3	29·0	113,500	5,080	3,910	260
Circulator (also baffle) fins . .	L.	1·61	2·12	11,250	6,900	5,300	390
Multi-point geyser with finned tubes	,,	0·715	17·41	63,000	8,100	3,760	376
Storage heater (finned) . . .	,,	3·57	3·74	20,640	5,950	5,530	360
Storage heater (larger model) .	,,	6·62	5·96	32,500	5,290	4,770	320
Wash-boiler (plain)* . . .	B.F. contact	9·08	9·08	9,100	1,100	1,100	..
Wash-boiler (6 fins)	,,	,,	10·77	10,930	1,204	1,016	..
Wash-boiler (11 fins)	,,	,,	11·42	11,990	1,320	1,048	..
Wash-boiler (22 fins)	,,	,,	13·95	12,000	1,330	860	..
Kettle (finned) .	,,	1·0	2·22	3,640	3,640	1,642	..

* Included in this table for more ready comparison with finned boiler.

It will be seen that the values of Q vary greatly for appliances of not very different thermal efficiencies—all the appliances shown, with the exception of the wash-boilers, pan, and kettle, having efficiencies of between 70% and 80% —from which it may be concluded that by suitable modification of design many of the appliances could be made to give the same heat output with a reduced net area of heating surface. Furthermore, the pan and plain wash-boiler, both having bunsen flames with flame contact, give the highest and lowest recorded values of Q net. They are examples of appliances in which efficiency has been sacrificed to general utility and cheapness of construction, and are particularly interesting as illustrating that an intense *local* heat transfer does not necessarily imply a high thermal efficiency, both having efficiencies of the order of 50%. Similarly, an intense overall heat transfer does not *necessarily* imply exceptionally high thermal efficiency. The example quoted, of a conventional English design of single-point geyser, has the second highest value of Q net, and with it is associated a high flue temperature and risk of discolouring fluepipe unless suitable material is chosen for the latter.

If intense, compact, heat transfer alone had to be considered an aerated flame making surface contact would always be employed, together with residual surfaces of maximum convection efficiency. Such a burner has serious disadvantages, however, some of which have been previously noted, and to which may be added local overheating, associated with possible heavy local scaling, thus leading to reduced life of sheet or cast metal through "burning" the former and cracking the latter. The relative importance of the advantages and disadvantages of the aerated flame clearly depends on the type of appliance for which it is intended. To take an extreme example it is of more importance to be able to boil a kettle of water quickly—by using a relatively high gas rate and the intense local heat transfer due to flame contact—than to be able to boil it efficiently at a lower rate of heat transmission. On the other hand, in a still, a café boiler, or steam-raising boiler, such flame contact would need to be used with a discretion and special attention paid to the regular removal of scale. It would be preferable to aim at securing a good heat transfer, more evenly distributed over the whole heating surface, which should be kept as small as is compatible with other requirements, by one of the general methods suggested earlier.

Controls, Materials, Finish.

I have dwelt at some length on the more fundamental aspects of water heater design, since however good looking an appliance may be and however ingenious its controls, it will, in the long run, be a commercial as well as a technical failure if due atttention is not paid to these aspects. Yet to the consumer, the salesman, the distributing engineer, the fitter, and the maintenance man they are of less obvious importance than those mentioned at the beginning of this paper.

All these people must be considered by the designer if his design is to be successful, and they present him with an interminable series of puzzles of varying degrees of difficulty. It would be impossible in a paper of this scope to deal fully with even a few, and I must confine myself to some general remarks.

Throttles, Pressure Points, Governors.

To one who regards safety as the first requirement of a gas appliance of any type, it is surprising that such elementary controls as variable gas throttles are omitted from appliances not fitted with an integral governor and unlikely to be so fitted. Especially in conjunction with a pressure point (on the burner or at some point on the outlet side of the gas throttle or any other variable gasway) they greatly facilitate correct adjustment and cost but little. Of less importance, but frequent value, since appliances have to be fitted over areas having widely different ranges of water pressure, is a water throttle, more especially on non-storage types of domestic heater. Throttles alone will not, however, prevent unwanted variation in the gas or water flow; they merely provide means of correct initial adjustment of these flows. The maintenance of correct flow can only be ensured in most districts by the addition of some form of governor. Gas governors of either constant pressure or constant volume type are familiar to you all and were the subject of a Paper by Mr. W. E. Benton[55] last session. It should hardly be necessary to urge their more general inclusion as an integral part of the design of a water heater, more especially as the increased output allowable on a governed appliance usually offsets the increased cost. Water governors are less common—tank water supply often serving equally well—but installation could be simplified and service to consumer improved if more attention were paid to the design of cheap and simple types. Great accuracy of working is not essential, and the small water governors now included in some types of non-storage heater are reasonably adequate.

Auto Valves.

One or other of these controls may be combined with an automatic valve, or the latter may be independent. Current designs vary greatly in design, and there is room for improvement in many. Quiet ignition, secured by the use of a slowly opening valve in combination with a suitable burner,* is especially desirable in multi-point but would be advantageous in single-point heaters.

Thermostats.†

For storage types of appliance, circulators, central heating units, steam-raising boilers, &c., thermostats are an indispensable means of securing economical and automatic working, as is now generally recognized. The available designs are, with with few exceptions, reliable, but frequently leave something to be desired in ease of disassembly for internal cleaning, readjustment (where necessary),‡ suitability for neat fixing, and, above all, external appearance and ease of external cleaning.

Thermo Control of Water Flow.

There appears to be a use for a thermostat (for non-storage heaters) which will control the water rate to give any desired outlet temperature irrespective of inlet temperature. So far as I am aware no such gadget is available. It would have obvious advantages over a thermostat controlling the gas rate, if it could be made easily adjustable to give any outlet temperature over the usual range required. A similar thermostatic flow restrictor could probably be used in place of the fixed restrictors now common for controlling circulation in storage systems, but would be more susceptible to scale formation in such systems owing to the lower flow velocities, and the fact that it would necessarily be fitted in the flow rather than the return pipe. In the non-storage type, the auto-restrictor could be on the inlet (and therefore free from any danger of scaling) if made sensitive to inlet temperature variations between about 40° F. and 70° F.

Temperature Indicators.

For storage heaters, especially those of lower gas rate (up to about 30 c.ft./hr.), a water temperature indicator

* *E.g.*, pinhole type. Geyser jets, widely spaced are rather less suitable.

† Recent types are a marked improvement, allowing easy valve cleaning without disturbance of setting.

‡ *Cf.* Benton [57] on cooker thermostats; much of the paper is applicable ot similar controls on water heaters.

is a useful adjunct, with a definite sales value. One type at least will be familiar to most of you, but there are other interesting possibilities, among which may be mentioned the use of pigments which change colour with temperature."[60]

Safety Devices.

Safety devices are numerous, and appear to offer some good "sales points." There is a noticeable tendency to magnify their number, following American practice,[61] which I do not regard as altogether desirable, since they may lead to carelessness in use and a false sense of security more dangerous than the somewhat remote chances of accident in their absence. Nevertheless, much depends on their design, and reliable thermally and pressure operated cut-offs, of which the former are more generally useful, have very real value for domestic apparatus on automatic supply. The former are usually controlled by a bimetal strip, the preliminary heat treatment of which is of considerable importance if fatigue of the bimetal is to be avoided. The auto-valves already mentioned are, of course, a form of safety device designed to prevent, among other evils, damage to the appliance. On larger appliances thermostats, water level deficiency valves, &c., serve a similar purpose. On all types of heater the use of safety cocks, of which many designs are available, is to be commended.

Ignition.

In these days of automatic ignition it is somewhat surprising that few, if any, water heaters are equipped with ignition devices. Developments in other departments—lighting, cookers, fires—have been rapid, mainly owing to the pressing needs of the first mentioned in competition with electric lighting. Water heating has not quite such severe competition to meet at present, but that is no reason for postponing indefinitely the inclusion of similar devices in water heaters, more especially of the non-storage type.

Materials and Finish.

There is need, too, for more enterprise in choice of materials and finish, especially the former. Domestic appliances, for example, are, with few exceptions, made largely of copper or cast iron. Tradition is partly, though of course not wholly, responsible—cost playing an important part. Is it too much to hope that progress in metallurgy and metallurgical and manufacturing processes may deliver us from the bondage of copper and "cast?" There are already indications that experiments in this direction can be commercially successful as well as scientifically interesting.

The improved finishes adopted in recent years have undoubtedly assisted sales materially. Vitreous enamel and chromium plate are now used for most good-class appliances, while bakelite (usually black, although colour could advantageously be introduced) is used by several firms for small fittings, such as flue caps, handles, trays, &c. One cannot help hoping that alternatives of at least equal merit will be found, if only for the sake of variety. Vitreous enamel in particular, good as it is in many respects, introduces difficulties when appliances are hired and have to be renovated.

Conclusions.

I have endeavoured in the preceding pages to survey the more obvious factors affecting the design of gas-fired water heaters. I am conscious of omissions and shortcomings—in particular the perfunctory attention to economic considerations (though I hope I have sufficiently indicated a realization that manufacturing costs must often prevent the attainment of ideal conditions), the lack of quantitative data (though its inclusion was virtually impossible if the paper was to be of reasonable length), and finally the small amount of original material. There is one last point which I feel should be mentioned—the appearance of the finished article. You will all have your views on this and none can prove his to be correct. We can, however, probably all agree on certain standards, of which fitness for purpose is the most important. Attention to this will prevent a further toleration of ornate decorations and elaborate fittings—controls, legs, lighting doors, &c.—which still mar some otherwise good designs, owing to a failure to think of the completed design as a whole. It is useless to design individual parts, however good in themselves, if they do not look well when assembled. It is equally useless to design for appearance only without due regard to function. There is to-day a general tendency—which personally I think is sound—towards simplicity of line and surface. Such a tendency need not, as is sometimes assumed, confine design solely to cubes, spheres, and cylinders, though these simple shapes will figure largely.

There can, in fact, be no best design from the point of view of appearance, since this will depend on surrounding decorations and fittings. It is somewhat surprising that this aspect, especially in relation to domestic appliances, has received comparatively little attention, as there seems no doubt that architects and owners will increasingly demand unity of design for the various units commonly required to be housed in the same room. At present we sell appliances of different kinds with finishes which match or contrast well; but more than this will be necessary in the near future. It should not be impossible to secure better co-operation between the manufacturers of the various individual types and between all manufacturers and leading architects and designers. The Gas Industry has made many contributions to the amenities of modern life. Here is another which can cause no conflict between the Industry's commercial aims and its social conscience.

I have in the references endeavoured to give due acknowledgment to the authors I have consulted. I must add my thanks to my colleagues at Watson House for their assistance and criticism, and to the Governor and Directors of the Gas Light and Coke Company for permission to publish this paper.

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Discussion

The PRESIDENT (Mr. F. C. Smith, of the Gas Light and Coke Company), in opening the discussion, remarked that they had listened to an extremely interesting Paper. The subject of heat transfer must be one of interest to works engineers, while it was certainly of interest to those engaged on the distribution side. They were fortunate in having with them that evening several gentlemen who were intimately associated with the design of water heaters, and he hoped they would contribute to the discussion. Mr. Smith said that they would also welcome questions or contributions from any of the new Student Members who were present.

Mr. C. A. MASTERMAN (Gas Light and Coke Company), in the course of a written contribution to the discussion, said that he found the paper a very interesting and useful one. It might not be clear at first sight why attention required to be directed to the efficiency of heat transfer, since many gas appliances might be said to be already at their maximum efficiency in the sense of transferring the maximum desirable amount of heat from the burning gas to the medium to be heated. The point, however, had well been brought out by Mr. Noble that by understanding the problem of heat transfer it was possible to design and manufacture appliances not necessarily of greater thermal efficiency in the narrow sense, but appliances more compact in size, more easily maintained, and more likely to make an appeal to the potential customer. There was little merit in designing an appliance, which, while perfectly constructed from the scientific point of view, could not be sold by reason of its cost or appearance. Gas undertakings carried a greater load of responsibility than did any normal retailer. For gas to be used, the customer must be persuaded to install an appliance, and must therefore be persuaded that the appliance will fulfil his purpose. General appearance was a large factor in this initial negotiation. For many retailers this represented the whole problem, and, the sale having been effected, they could, in effect, disclaim further interest. The gas undertaking, on the other hand, must persuade the customer that the appliance required to be installed, and it must be capable of being installed satisfactorily. It must then, with the minimum of attention, fulfil the consumer's purpose at a minimum cost for fuel, &c.; and it must finally be capable, when maintenance is given, of being maintained easily. The designer must even bear in mind the amateur home enthusiast with a screwdriver, whose curiosity would often lead him to make experiments with a gas appliance to the detriment of performance, for which the appliance rather than the enthusiast would be blamed by the consumer.

Advanced Work.

Mr. Noble's Paper (continued Mr. Masterman) would have drawn their attention to some of the advanced work on heat transfer which was now being carried out in this and other countries, and the application of this work to the appliances which they were now handling in the Gas Industry could not fail to be of interest. He would like to ask Mr. Noble whether the conventional design of geyser, having a large combustion space, depended to any appreciable extent upon gas radiation for its heat transfer. He imagined this to be the case, and, if so, it was an interesting example of rule-of-thumb methods anticipating the results of advanced scientific work. They would remember that one of the most striking results of research into the manufacture of beer was not in the improvements which had been effected in that direction, but rather in the confirmation by scientific experiments and knowledge of the very high degree of correctness of the rule-of-thumb technique in beer manufacture arrived at after centuries of experience. It had not necessarily followed in this other industry that its product " beer " had been improved by scientific research—that was for consumers to judge—but quite certainly in the direction of design of gas appliances the application of knowledge would lead to much-wanted improvements. He therefore felt that Mr. Noble deserved congratulations for the convenient summary he had set out in his Paper showing the present position of knowledge.

Of Importance for the Practical Man.

Herr Dipl.-Eng. W. MARX (Dessau, Germany) expressed his whole-hearted admiration for the immense amount of work Mr. Noble must have put into his Paper. Only those who had been personally connected with similar work on the subject of heat transfer would be able to realize fully the extent of this work. From his own personal experience of the design and manufacture of gas-fired water heaters he appreciated the great importance of this Paper for the practical man, although his remarks might often have sounded purely theoretical. He would especially mention the importance at the present time of transfer of heat by radiation—a subject which had hitherto been somewhat neglected. The contributions made by his colleague, Herr Geck, to which Mr. Noble had also referred, showed that this method of heat transfer called for special consideration in the design of such apparatus. In pursuance of this tendency, it had lately been found possible to increase efficiency by 4 to 5% by providing the inner body of a gas-fired water heater with a coat of paint of special ingredients. This result might have been achieved from the roughness of the surface, brought about by the cover of paint. Mr. Noble had drawn their attention to the beneficial results obtained from such roughness. Furthermore, dark paint resulted in an increased capacity of the surface to absorb heat.

To some people an increase in efficiency of only 5 to 6% might seem rather small. It should, however, be borne in mind that the efficiency curve was a parabolic one. In the region round about 80% efficiency which they had reached to-day they moved on the flat part of the parabola, and further progress of every single per cent. must be hard fought for. Water heaters which embodied this latest development were already available in this country.

Special stress had been laid in the Paper on the advantage of a gas pressure governor in the water heater. It seemed to him, however, that all the possible advantage had not yet been derived from the governor. It might be justifiable to demand that heaters which did not embody a gas pressure governor must be capable of an overload of 40%. That might depend on the main system. He did not know, however, whether an increase in the gas pressure of 100% at any given point might occur here. It did not seem to him to be justifiable to demand of heaters which embodied a gas pressure governor an overload capacity of 20%. This would correspond to a pressure increase of about 40%; but a governor which allowed such an increase to pass did not, in his opinion, deserve the name of gas pressure governor. The tendency during the last four years had been for precision. As a result, a heater was now available which embodied a governor guaranteeing a constant gas pressure within very narrow limits. It seemed to him, therefore, that the extra cost of the governor should not be compensated for by a reduction in the reserve capacity of 20% only. On the contrary, it should be realized that a governor offered the equivalent of a far greater reserve capacity, and therefore made actual savings possible over and above the cost of providing the governor. A good governor prevented any overloading, which was the most frequent cause of trouble and damage. Why should it therefore be necessary to make the heater 20% larger than its normal capacity would require? This subject had been dealt with in Germany at considerable length by various committees of experts; and, as a result of their deliberations, a reserve of only 10% had been decided upon for heaters embodying a governor. This seemed justified in order to provide an equivalent for the small differences which might occur in the actual course of manufacture. It was to be hoped that after a certain period of experience with gas governors embodied in heaters, it would be generally realized that a reserve of 10% would be sufficient, so that it would be possible to produce a geyser capable of giving a higher output for the same price.

Control of Water Rate.

Continuing, Dipl.-Eng. Marx remarked that Mr. Noble had described it as desirable to embody a device in non-storage heaters which would control the water rate to give any desired outlet temperature, irrespective of the inlet temperature, by means of a thermostat. He knew of a device embodied in a certain German make of heater, which might be regarded as a first step in this direction. This device included a handle by means of which any desired outflow temperature might be obtained. It was further combined with a water volume governor, which guaranteed that the temperature selected would be maintained. The outflow temperature, therefore, was not varied by fluctuations of the pressure in the water main, which, in most heaters, influenced this temperature detrimentally. It would therefore be seen that by employing this device, the fluctuations of pressure in the water main were eliminated, but not the variations in the inflow temperature, which varied, for instance, with the seasons. A device which would also eliminate the variations in inflow temperature was in course of preparation, and was the subject of a new British Patent already granted.

He also referred to Mr. Noble's remarks regarding a substitute for copper, which at the moment was so extensively used in the manufacture of heaters. It had long been desirable to find a cheaper material than copper, thereby making a general reduction in production cost possible. Extensive research work had been and was being carried on in this direction in Germany, where this question, for reasons generally known, was of great importance at the moment. Aluminium, to which first attention had been directed as a suitable substitute, had so far not given satisfactory results. There seemed, however, to be little doubt that progress would eventually be made in this direction, probably leading to cheaper heaters and thereby bringing hot water by gas within the reach of even the poorer classes.

Function of the Designer.

Mr. W. E. BENTON, M.Sc. (Cannon Iron Foundries, Ltd.), also congratulated Mr. Noble on his Paper, which, he said, made a real contribution to a difficult subject. Mr. Noble was particularly happy in his style. On a complicated technical subject of this kind it was easy to write an " unreadable " paper —one which would be promptly buried in the transactions and never again consulted. It was difficult to write a paper which would remain alive—one that would be referred to again and again—and in this he thought Mr. Noble had been successful. In his introduction, the Author had said: " It is possible that there exists a certain misapprehension as to the function of the designer in regard to heat transfer; it is certainly not to strive for thermal efficiency at all cost." Mr. Benton said he was glad this point had been expressed so definitely, and it could not lose by repetition. If there were time he

would have liked to say more on this question; but Mr. Noble had amply justified his statement in the Paper.

The subject of convection had been introduced with the words: "The mathematics of heat transfer by convection is extremely complicated." Now "mathematics," said Mr. Benton, was a horrid word. The mere sight of a strange mathematical expression of some new and terrible form was liable to give one an incurable sinking feeling. They must make a distinction between mathematical and physical difficulties. In this subject of heat transfer the problems were mostly physical, and in only a few isolated instances had mathematics been called in to complete the picture. An example was the well-known work of Prof. Louis V. King, of Toronto, on the loss of heat by natural convection from electrically heated wires, a research which led very brilliantly to the invention of the hot wire anemometer. In this work Prof. King succeeded in establishing certain fundamental physical assumptions, which, when expanded with the aid of mathematics, led to results which agreed with his experiments. But such cases were few and far between. The method which had been used most widely for giving some general form to the immense mass of experimental evidence was that known as the application of the principle of dynamic similarity. Now the root idea at the basis of this method was that one should be careful that quantities that were equated should be of the same physical dimensions—*i.e.*, when a temperature was equated to a complicated expression containing many different physical factors, that expression should be dimensionally a temperature. If Dr. Fishenden's equations were examined with this interpretation, one would discover that they were more understandable than appeared possible at first sight. In the equation representing the loss of heat by natural convection from a horizontal tube, one might detect a velocity of the same form as the terminal velocity in Stoke's formula.

Reference had been made by Mr. Noble, continued Mr. Benton, to the increase of heat transfer when the velocity was given a component normal to the surface. Of course, there could not be a component normal to the surface *at* the actual surface. Within a very short distance the gases must turn and become tangential. What actually happened was that as the normal component was increased, this small distance was reduced, while the velocity gradient correspondingly increased. Now the dragging force on the surface was proportional to the velocity gradient and the heat transfer to the temperature gradient, and, since the temperature gradient increased with the velocity gradient, the heat transfer would increase as the normal component increased. In conclusion, Mr. Benton thanked the President for affording him this opportunity of contributing to the discussion.

The Last Few Per Cent.

Mr. P. Lloyd (Gas Light and Coke Company) congratulated Mr. Noble on his Paper, which had given him much thought on a number of problems and had drawn attention to a number of facts and papers which were new to him. Reasonably high efficiency depended to a great extent upon the last few per cent. of heat from the flue gases. The first 65 to 70% of the heat of the gas input was very easily obtained; it was only the next 5 to 10% which began to present difficulties, and over this range heat transfer by convection was the deciding factor. They would all agree, after hearing Mr. Noble's paper, that convection problems could only be described as extremely "baffling." In regard to the phenomenon of increased heat transfer over a tube of streamline shape he said that he would like to hear more about this because he was not quite happy about the suggestion that there was a dead pocket behind the circular tubes where only a limited amount of heat transfer took place. The result of recent investigations showed that there were two positions in which a maximum of heat transfer took place—namely, at 45° and 180° respectively from the upstream position. (That was to say the down stream side was one of the maxima.) But the minimum was at 90° from the upstream position. According to conventional ideas, the linear velocity at this point should have been very high, and the thickness of the film should have been very inconsiderable. He did not see how these two experimentally divergent facts were to be squared up. He would also like to ask a question in regard to the use of baffles in flueways. It seemed to him that the effect of these baffles was really the same as the effect of reducing the cross-sectional area of the flue. If one took a rectangular flue, the insertion of the baffle would have the effect of stimulating the turbulence and consequently of increasing both heat transfer and resistance to flow. If one narrowed down the flue one obtained an exactly similar effect. To what extent could the two effects be considered equivalent?

Mr. L. T. Minchin, B.Sc. (Gas Light and Coke Company), enquired why it was desirable to have a large combustion space in the lower part of the heater. He further thought that it would have been better to have had a differently shaped primary combustion space so that the thickness of the cold CO_2-containing layer, which absorbed the radiant heat, was reduced. The question of radiation from the gases was one of considerable interest to him. The corrosion of the internal parts might be reduced if it were possible to have a layer of stagnant pure air close to the water surfaces, which would be transparent to radiation, so that one effected heat transfer in this way without any actual contact between the flue gases and the water surfaces. This might be a possible method of obtaining the necessary heat transfer without actual contact of the sulphur-containing products with the metal surfaces.

Locating Points of Restriction.

Mr. T. J. Legg, B.Sc. (Gas Light and Coke Company), referring to the section on ventilation, remarked that with some water heaters, more especially those which had complicated interiors, there was some difficulty in locating the points in the flueway at which restriction was occurring. He suggested that by blowing air at room temperature through the appliance at a fairly high velocity, and measuring static pressures at various points, the values of k could be obtained. Furthermore, from information given in the paper it should be possible to estimate accurately enough the flue gas temperature at these points and thus to determine where the controlling resistance was situated.

Mr. R. Summerson (Luton), Junior Vice-President, said it occurred to him that the Boys calorimeter might be regarded as a water heater working at maximum possible efficiency. This apparatus was introduced as long ago as 1905; and the heat interchanger in this instrument consisted of an inner and outer coil of finned tubing. The products of combustion passed through this instrument in 10 to 15 seconds, and in that time the temperature was reduced from approximately 2,000° F. to within 2° or 3° of the inlet temperature. He inquired if Mr. Noble knew of any commercial firms of water heater manufacturers which embodied in their appliances this type of interchanger; and was there any reason why such a type should not be employed?—not necessarily at 99% efficiency, of course, which was rather more than one expected in any appliance.

Mr. L. H. Pinkess, B.Sc. (Gas Light and Coke Company), also referred to the question of radiation from the hot gases, and remarked that he was disappointed that some indication had not been made of the temperature of the flue gases and the amount of heat transfer due to radiation, and the relation between these two factors. He was also interested, he said, in the streamlined form of the tubes; and it seemed to him that the points of maximum heat transfer were of relatively little importance. Although the peaks of heat transfer were very sharp on a circular tube, and the transfer might be great at particular points, the overall transfer might not be so great as on streamlined tubes with their more uniform distribution of heat transfer.

The Author's Reply.

Mr. Noble, in replying, expressed his general agreement with Mr. Masterman's remarks, but disclaimed being sufficiently an authority on the subject of beer to make any comments other than to suggest that the company might make tests for themselves after the meeting! In answer to Mr. Masterman's question it was probable that in the conventional design of geyser a large proportion of the heat transfer (say up to 30%) was due to gas radiation, but he (Mr. Noble) had not yet had an opportunity of investigating the point in detail.

He was glad Herr Marx, a colleague of Dr. Geck, had joined in the discussion, and was interested to hear of the experiments on heaters with painted interiors. He must however disagree strongly with the suggestion that the overload required on a governed appliance should be further reduced. It was not insisted upon to deal with deficiencies in the governors themselves but to allow for the inevitable falling off in the combustion standard of an appliance with use. It was interesting that in Germany a lower standard was regarded as satisfactory, but standards on other things varied owing to differences in national points of view. It was, to the best of his knowledge, true that no accident due to incomplete combustion had occurred with an appliance conforming to his Company's requirements and properly installed. It was a great thing that this could be said and he would be loath to reduce a standard so easy of attainment. He was interested to hear of the new developments in thermostatic control of non-storage heaters and looked forward to examining samples in due course.

He was glad that Mr. Benton (whom he thanked for his compliments which were the more appreciated as coming from one who had written so many first-class papers) had emphasized his remarks as to the function of the designer, especially in view of some recent comments in the gas Press on the deficiencies of English designers and laboratories. He apologized to Mr. Benton for using the word "mathematics" and agreed that "physics" was preferable. The importance of the principle of dynamic similarity referred to by Mr. Benton and by the author could hardly be over-emphasized—it was, of course, vital that so far as possible any equations used in practice should be dimensionally correct. With Mr. Benton's remarks on gas flow normal to a surface at the surface, he agreed, but he would go further and suggest that at that moment Mr. Benton was not sitting on a seat but on a film of air, so thin however that it hardly affected his comfort!

In answer to Mr. Lloyd, he agreed that ultimately heat transfer by convection was the controlling factor and hoped that this had been made clear by the emphasis in the paper on the need for convecting surfaces. With regard to Mr. Lloyd's comments on streamline tubes, he thought the experimental evidence he (Mr. Noble) had quoted was reliable, but in the subject of heat transfer conflicting or apparently conflicting data were often met. Without referring to the paper mentioned by Mr. Lloyd, he could not express a definite opinion, but would only suggest that possibly the thermocouples used had affected the surface flow. This phenomenon had been observed by other investigators and special precautions had to be taken to avoid error due to this cause. The effects of a baffle and a narrowed flue were indeed similar, though specific effects could be obtained from baffles; but for constructional reasons it was often more convenient to keep a flue way of constant area and introduce a baffle, rather than reduce the area of the flue to correspond

with the diminishing volume of gases, as the latter cooled in passing through the appliance.

Reason for Large Combustion Space.

Replying to Mr. Minchin, he stated that a large combustion space was needed primarily to enable the gas to burn at all, since at the moment of combustion it was hottest and occupied the greatest volume. Its advantages from the point of view of gas radiation had been discussed in the paper. He did not see how it would be practicable to arrange for a layer of air as suggested by Mr. Minchin, though somewhat the same effect was produced by a double metal wall with air between the metal layers. But, even so, corrosion of the inner wall occurred. He agreed with Mr. Legg as to the difficulty in determining the effective resistances in many appliances and considered Mr. Legg's suggestion for measuring the values of k, and hence the controlling resistance, to be sound. He hoped that he might give Mr. Legg, who was his valued assistant, the task of making such measurements at a future date.

As Mr. Summerson had suggested, the Boys calorimeter was really a high-efficiency coil type condensing geyser—in fact, of too high an efficiency for ordinary circumstances. Capital and maintenance costs for a large-scale water heater on those lines would, he thought, be too high.

He was sorry he had not given Mr. Pinkess as much information as he wanted, but thought the references in the paper would prove adequate. He had indicated that gas radiation increased rapidly with temperature and had given some illustration of the magnitude of the effect in practice—but the paper had to stop somewhere! He agreed with Mr. Pinkess's remarks on circular and streamlined tubes and hoped that some manufacturers would look further into the possibilities of applying the results described in the paper.

In conclusion, he thanked the audience for their attention and for their contributions to the discussion, and apologized for keeping them until such an hour that it would be necessary to go to the other side of Holborn to carry out the investigation mentioned earlier.

Vote of Thanks.

Mr. J. M. WEBBER (Croydon) proposed a hearty vote of thanks to Mr. Noble for his very interesting Paper, remarking that the general principles of heat transfer were equally applicable to the gas-works where large volumes of gas had to be cooled by passing them through tubes surrounded by water.

The vote was seconded by Mr. R. SUMMERSON, and was briefly acknowledged by the Author.

The Work of an Industrial Centre

A Paper read before the Southern Association of Gas Engineers and Managers at the Autumn General Meeting in London on Nov. 30, 1934.

By W. DIETERICHS, Assoc.M.Inst.Gas E., of the Gas Light and Coke Company

(*Concluded from p. 824.*)

Assay Furnace.

Fig. 2 is an illustration of an assay furnace, and its history is very interesting. A few years ago one of our largest consumers—a firm of refiners and bullion merchants—was being canvassed by an electrical furnace manufacturer, and an electric furnace was supplied on approval. I should like to mention that up to this time the firm was rather reluctant to have any representative from the gas undertaking in the factory. The Gas Light and Coke Company, however, received information that this test was being carried out and contact was eventually made with one of the Directors who himself seemed unwilling to consider gas a possible competitor to the new electric furnace. Very careful tests were made, meters being fixed on the electric and gas furnaces, the work being carried out under the same conditions. I should like to add at this point that the existing gas furnace had been in use for a number of years and the design was at least twenty years old. After a lengthy test the following results were obtained:

Old pattern gas furnace—7½d. per hour.
Modern electric furnace—5d. per hour.

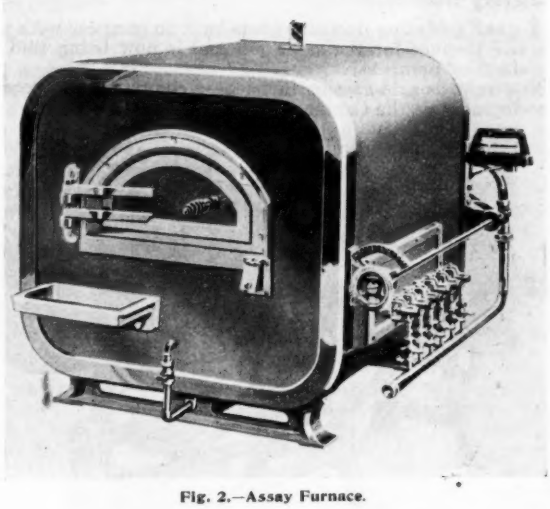

Fig. 2.—Assay Furnace.

It was pointed out to the consumer that the tests would not give a fair comparison, and he agreed to give us three months to show what a modern gas furnace was capable of doing. We carefully examined all the manufacturers' lists, and found there was no standard type of furnace capable of doing this job. It was therefore decided to design a special furnace immediately, with the result that we produced the modern gas furnace illustrated in fig. 2, which was found to do the same job as the electric furnace for 2¼d. per hour, and owing to the flexible adjustment, the operators preferred to use it. The outcome of this was that immediate orders were received for some 10 or 12 furnaces on the Gas Light and Coke Company's area of supply and elsewhere, which I think is sufficient proof that for this particular work the modernization of the gas furnace enabled us not only to compete successfully but also to offer our customers a real advantage over our competitors. This also brings out the point that an obsolete and inefficient apparatus is a target for competing fuels.

Combustion Tube Furnace.

The combustion furnace shown in fig. 3 is another illustration of the difference between obsolete and modern design. Investigation showed that we were not selling sufficient equipment for laboratories, and the number of old pattern combustion furnaces which were being sold by

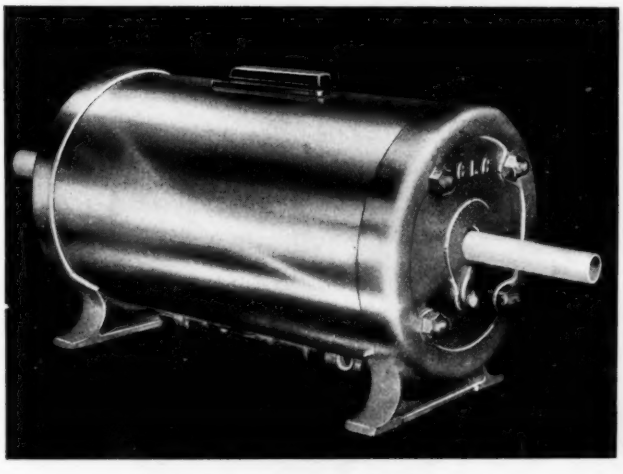

Fig. 3.—Combustion Furnace.

FIG. 4.—DOUGHNUT FRYER.

us was falling rather rapidly. This was noticed, and it was decided that something more modern was required from the point of view both of efficiency and of appearance. A new furnace was designed, and I am glad to say that in one month we have sold more of this type of combustion furnace than we had in the previous twelve months of the old pattern furnace. As there is a national demand for this type of furnace, the design has been handed over to manufacturers who have a sales connection with laboratories.

Automatic Flue Damper.

It was felt that large industrial equipment needed some form of automatic damper control, which could be used to reduce the flue area in proportion to the gas rate, and after extended experiments it was found that quite a simple form of diaphragm operated control could be developed. This appliance is now being examined by one or two makers with a view to its manufacture.

Doughnut Fryer.

Fig. 4 shows an interesting development for doughnut-frying. This is a simple application, and since its development there has been a growing demand which indicates the need for this type of appliance in the baking industry.

"Thermspray" Boiler.

The "Thermspray," shown in fig. 5, is already well-known, but up to the time of its development this particular load was almost entirely electric. The development was completed about 18 months ago, and in order to gain experience the first six boilers were manufactured in our own shops, as a result of which we were able to hand this boiler with confidence to a manufacturer who was already well-known in the baking industry. It was found easy for this firm to interest clients in this boiler, and it is known that some 200 have been sold.

Soldering Iron Stove.

A small soldering iron stove was built to compete with the electric furnace for the same job and is now being sold in satisfactory numbers.

Fig. 6 shows a de-gassing furnace—a comparatively recent development at the Centre.

Fig. 5.—Bakery Boiler.

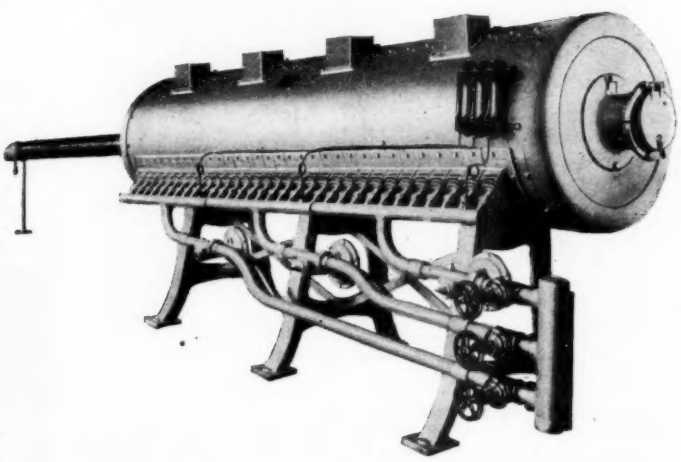

Fig. 6.—De-gassing Furnace.

Milk Heater.

Fig. 7 shows another recently developed appliance—a small-scale milk heater—which has considerable possibilities for use in retail dairies. This was designed in response to the request of a large milk concern in London which required an appliance for heating small quantities of milk rapidly, cleanly, and simply for immediate consumption. They had attempted to use electric heating for the process, but had been unable to overcome the difficulties involved. Twenty sample heaters of this type have now been on test for over a year, and a further fifty are now being installed. I think from the encouraging remarks

I have heard regarding this new heater that in the near future there will be a growing demand for its use, and once the public know that hot milk can be obtained from the dairy in this way, a considerable number will be required throughout the country. As soon as the necessary arrangements have been made it is hoped to hand this apparatus to manufacturers of dairy equipment.

Fig. 7.—Milk Heater.

I am sure you will all agree that this development work as part of the duties of a Centre is of vital importance, and it is to be hoped that each Centre will do its utmost to get into touch with manufacturers of all apparatus requiring heat in order that efficient gas consuming equipment can be put forward.

It is essential, of course, that this work should be done both skilfully and tactfully, for should the recommendations of a Centre lead a firm of appliance makers into difficulties of any kind they will very naturally blame the Gas Industry as a whole and may tend to become prejudiced against the use of gas. In choosing suitable firms to manufacture new appliances some care is often required if subsequent complications are to be avoided.

Application of Gas to Miscellaneous Processes.

I have already mentioned the importance to the Industry of the innumerable firms manufacturing small appliances and articles of machinery requiring heat. As examples of the kind of appliances I have in mind, I will mention glazing machines for photographic prints, laundry appliances, fur-drying stoves, and glue heaters. In the aggregate, appliances of this type have an enormous fuel consumption, yet they are installed almost exclusively by the manufacturers themselves. In these circumstances, it is essential for us to help the firms concerned to apply gas to their own peculiar problems, for they are not usually working on a large enough scale to have their own technologist who could advise them on the use of fuels. It is very easy for firms of this kind, having once found a given fuel to be efficient for their purposes, to begin to specialize in the use of that fuel until finally they are very unwilling to use any other. It must be our job to see that this fuel, in which the firms specialize, is, as often as possible, gas, and if not we must try to ensure that the firm shall at least have an open mind on the subject. It is unnecessary to add that in this class of work the competing fuel is almost always electricity, which is very simple to apply. The appliance maker has simply to obtain the necessary heating elements and fix them to his machine; such problems as incomplete combustion, local overheating, and so on are either non-existent or very easily overcome; moreover, the cost of the fuel is often quite unimportant. By contrast, gas heating often requires to be very carefully thought out and applied if the best results are to be obtained.

The G.L.C. Centre at Watson House has been co-operating with a number of small appliance makers in this way, and it has been found that the trouble taken is amply repaid, since the firms in question are very appreciative of this service. This is one of the ways in which Centres are able to render important indirect assistance to their member undertakings. Many gas companies may have come up against the same problem from a slightly different angle in being asked to convert to gas firing appliances designed for electric heating. Anyone with practical knowledge of the difficulty of such conversions will realize the desirability of having the appliances designed for gas firing in the first place. A further group of manufacturers to whom similar considerations apply are the heating and ventilating engineers. At the present moment the majority of these firms are more conversant with the use of oil than with gas firing, but with assistance from the Centre they will often be prepared to put forward gas as a proposition.

Bread-Baking.

For some considerable time we have been considering the possibilities of gas for bread-baking. It is obvious that most of the bread-baking in this country at the present moment is not done with gas as a fuel, because in most parts of the country gas is too expensive to compete with the cheaper fuels, and the design adopted for gas firing by some makers is not as efficient as it might be. The figures for gas firing which were being quoted by some bakery engineers were much above what could be obtained with an efficient oven. Some bakery engineers had never considered gas as a fuel, coke, oil, and coal being the only fuels for which they were prepared to quote. Contact was therefore made with several of these firms, and I was impressed by their readiness to co-operate. Encouraging results are already being obtained with gas firing, not only on hot air ovens, the type most commonly employed for gas firing, but also on steam tube and side flue ovens which have so far been the monopoly of the cheaper fuels.

Co-ordination of the Work of the Centres.

Up to this point I have not said anything about the co-ordination of the Centres or the work which has been accomplished by their joint as opposed to their individual efforts.

The correlation of the work of the Centres is effected by monthly meetings of the Technical Sub-Committee composed of representatives of each Centre, together with representatives of the national bodies. These meetings not only make contact between the personnel of the Centres but also enable matters of policy to be dealt with on a national basis.

At first the Committee's attention was concentrated on the organization of the Centre scheme as a whole, and during this period the filing scheme previously mentioned was worked out. A standard procedure has also been devised for circulating inquiries from any one Centre to the other Centres, so that, in effect, any undertaking belonging to a Centre can obtain the assistance of the whole organization. Among the technical problems which have since been discussed are bakers' ovens, frit kilns, clinical sterilizers,

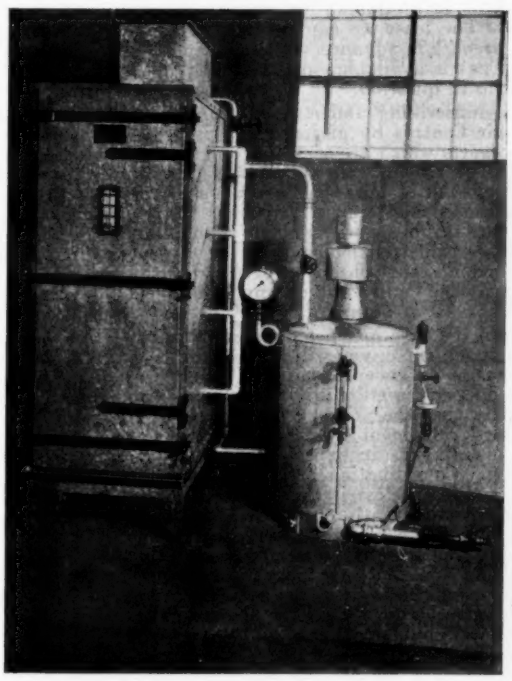

Fig. 8.—Sterilizing Cabinet and Boiler.

oxy-coal-gas cutting torches, and various types of furnaces. Bakers' ovens have so far received the most attention. It is obvious that with a Committee such as this the problem of dealing with manufacturers of equipment can be handled

in a much simpler way than was previously possible, any overlapping and duplication of work being easily avoided.

As a result of these meetings, various recommendations have been made to the Joint Co-ordinating Committee which consists of representatives of the three national bodies under the Chairmanship of Sir David Milne-Watson, and whose function it is to consider questions of policy affecting the Industry as a whole. This Committee in some cases authorizes the circulation of the findings of the Technical Sub-Committee to all subscribing undertakings.

For example, some time ago a request was made to all undertakings to supply the prices for gas for bread-baking. These prices were examined and compared with those of other fuels, and research was carried out by several Centres as to the best method of using gas for this process. The results obtained and conclusions drawn were embodied in a report to the Joint Co-ordinating Committee, with a recommendation of the price at which gas must be sold to compete with other fuels. Whether the price is possible is, of course, a matter for the undertaking to decide, but the report was considered by the Joint Co-ordinating Committee, and authority was given for each Centre to forward a copy of the report to each subscribing undertaking.

Member Undertakings.

So far nothing has been said about the part which the member undertakings can play in making the Centre scheme a success; but the fact remains that without their active co-operation the full benefits of the scheme cannot be obtained. It will be clear, for instance, from what I have already said, that the Centres cannot *find* new loads for their member undertakings. They can suggest new possibilities, interview prospective consumers, and investigate suggestions advanced by the undertaking; but the first contact with the consumer must almost always be made by the member undertaking itself. It will be those undertakings with the greatest initiative that derive the greatest advantage from the scheme, even if they belong to one of the Centres which is prepared to carry out industrial surveys for them.

One of the most essential contributions of the member undertakings to the scheme is the formulation of a clear price policy for industrial and commercial loads. The Gas Industry is already at a disadvantage with oil fuel in that the price of gas necessarily varies to a considerable extent from one place to another, whereas that of oil is approximately constant over wide areas. Heating engineers have often complained of the difficulty they experience in getting any firm price quoted by small undertakings for large loads. The least we can do to obviate this disadvantage is to prepare in advance tables showing the actual prices at which gas is available, so that these can be distributed to the firm in question.

The subscribing undertakings can also be of great help to their Centres by giving free criticism of any bulletins and reports which are sent out, and of any other aspects of the Centre scheme. If we know at first hand what are the requirements of our members we shall be able to render them much more effective service. I would also suggest that subscribing undertakings should not only send the fullest possible particulars with every inquiry, but should also give a report on any progress resulting from the steps taken by the Centre and on any other special developments in their area of supply.

From the description I have given of some of the activities of one Centre, you will realize what a wide field of work there is to be covered and how much work there is to be done in each section of it. I want to emphasize very strongly that the primary function of each Centre is to do actual development work, both technical and commercial, and to build up an experienced and well-equipped organization. Co-ordination between Centres is very important, but is quite useless if there is nothing to co-ordinate. I make this apparently obvious statement in order to correct an impression current in some quarters that a Centre is nothing more than a forwarding organization for written inquiries. In fact, the whole Development Scheme was organized to do away with the great bulk of vague technical inquiries which was beginning to clog the organization of the large undertakings.

In conclusion, I would add that the public regards the Industry as a whole, and the mistakes or inefficiency of one undertaking may react on the whole Industry. There must therefore be complete co-operation between all undertakings and the manufacturers of gas-consuming equipment, and we all hope the Centre Scheme will be the means of giving the necessary contact throughout the Industry.

[*Our report of the Discussion on Mr. Dieterichs' paper will be published in a subsequent issue.*]

Carbon Monoxide Poisoning

Acute and Chronic.

Prof. K. Süpfle in a lecture to the Institution of Gas and Water Engineers of Saxony and Thuringia—reproduced in *Das Gas- und Wasserfach*, 1934, 77, 825-830 (Dec. 1)—gave an account of carbon monoxide poisoning and the mode of action of this gas on the living organism. A distinction is, in general, made between acute and chronic poisoning. In acute poisoning, the attack is due to one dose of the poison, whereas in chronic poisoning the effect is due to repeated small doses. It had been fairly generally accepted that carbon monoxide gives rise to acute poisoning only, though, in some quarters, it was believed that chronic poisoning is also possible. Protagonists of the latter school of thought believe that the so-called kitchen sickness of housewives is an occupational illness due to carbon monoxide. As a result of numerous experiments carried out on dogs, the author has proved conclusively that carbon monoxide always gives rise to acute poisoning if the concentration of the gas is sufficiently high to produce any ill-effect at all. At lower concentrations, no adverse effect is produced but, on the contrary, the hæmoglobin content of the blood and the number of red corpuscles are increased as a result of a reaction on the part of the living organism which makes good the hæmoglobin fixed as carbon monoxide compound. It is thus established beyond doubt that chronic carbon monoxide poisoning cannot occur. Kitchen sickness is therefore not due to carbon monoxide.

Analyses carried out in gas-works showed that dangerous concentrations of carbon monoxide are only present transitorily in the neighbourhood of retorts, producer plant, and water gas plant. In other situations, dangerous concentrations are never reached. It is a satisfactory feature of town gas that a smell is apparent at a concentration of gas lower than that at which a dangerous concentration of carbon monoxide is present in the air. Thus, in the case of Dresden town gas containing 15% of carbon monoxide, the following observations were made:

Concentration of Gas in the Air.	Concentration of CO, Parts/Million.	Smell.
0·035%	50	Not perceptible
0·07 ,,	100	Just perceptible to some observers
0·1 ,,	150	Obvious, but faint
0·2 ,,	300	Immediately apparent

In this connection, it may be mentioned that a concentration of carbon monoxide of 100 volumes per million can be tolerated for many hours per day over long periods without ill-effect.

The affinity of hæmoglobin is 250 times as great for carbon monoxide as it is for oxygen, and, when the organism is exposed to carbon monoxide, a definite time is required before the hæmoglobin of the blood reaches a state of saturation equivalent to the concentration of carbon monoxide present. In an atmosphere containing 200 parts of carbon monoxide per million, or 0·02%, a period of 5½ hours is required for the carbon monoxide content of the blood to reach equilibrium corresponding with this concentration. Actually, fatal results do not occur until 80% of the blood hæmoglobin is rendered ineffective through conversion into the carbon monoxide compound, and this is not possible unless the inspired air contains 0·4% or more of carbon monoxide. On the other hand, up to one-third of the hæmoglobin can be converted into the carbon monoxide compound before marked symptoms of carbon monoxide poisoning become apparent. This requires a concentration of 0·04% or one-tenth the fatal concentration, and the results are not apparent until about 4 hours' exposure to the gas has been suffered.

The following table shows the relationship between the carbon monoxide content of the inspired air and the effect on the hæmoglobin of the blood and on the human organism.

Concentration. %	% of Hæmoglobin Finally Converted into the Carbon Monoxide Compound.	Time of Exposure (Hours) for Attainment of Equilibrium.	Result After Stated Time.
0·4	80	..	Quickly fatal
0·1	55	2	Symptoms apparent before stated time
0·05	38	3½	
0·04	33	4	Symptoms apparent
0·02	20	5½	Harmless

The Economics of Summer and Other Load Problems at Walsall

The Author, in a Paper before the Midland Junior Gas Association at Birmingham on Dec. 6, compares the cost of gas production by continuous vertical retorts and by a combination of horizontal retorts and C.W.G. plant.

By S. BROCKBANK, Assoc.M.Inst.Gas E., of the Walsall Corporation Gas Department

During the four months of the year, May, June, July, and August, the weekly load of the Walsall Gas Undertaking averages something like 11 million c.ft., whereas during the four winter months, November, December, January, and February, the average is nearer 16 millions per week. Thus, the load increases by something over 40%.

Superimposed on this weekly load curve is the daily curve, and superimposed on that, the hourly load curve. These variations can be taken by the use of carburetted water gas plant and holder capacity, but the base load variation must be met by a corresponding variation in the amount of base load plant in operation.

It is the object of this Paper to examine the factors which decide the most economical method of varying the amount of plant in operation, and the type of plant to be retained at work during times of reduced load.

Except for the holidays at Whitsuntide and August, the summer load variation is in the neighbourhood of half-a-million c.ft. per week, but an exceptional spell of hot weather during the summer may increase the variation to as much as 1½ million c.ft., so that provision must be made for this contingency.

The declared calorific value for our Undertaking is 450 B.Th.U. per c.ft., and this value has been in operation since the Gas Regulation Act was brought into being. We attempted to keep the calorific value of the outgoing gas at a constant figure so that any method of gas manufacture we adopted would have to give ease of control and proper mixing of the gas before we could accept it as suitable. Linked up with the question of calorific value is the question of specific gravity Although there is no legal obligation to supply gas of constant specific gravity, there is an obligation to the consumer to supply gas which will give consistently good results without frequent adjustment of burners. This can only be obtained by supplying gas of constant specific gravity as well as of constant quality. The method of gas manufacture would therefore also have to give gas of constant specific gravity.

Plant Available.

The plant available for gas-making at these works consists of twenty continuous vertical retorts set in five beds of four each; seventy through horizontal retorts with charging machinery, set in seven beds of ten each; and one carburetted water gas set.

The vertical plant consists of five beds of Woodall-Duckham continuous vertical retorts, each bed containing four retorts with separate internal producer and regenerator. Each retort measures 55⅜ in. by 10 in. by 25 ft. and is of a nominal capacity of five tons of coal per 24 hours. Coal is handled by a gravity bucket conveyor to the overhead hoppers. Coke to fires is handled by a lift and coke extracted from the retorts is discharged into skips handled by the telpher. Included in this plant is a water-tube waste-heat boiler which raises sufficient steam for steaming the retorts and fires and the surplus steam from which is discharged into the works' mains.

The maximum yield of this plant when producing gas at 450 B.Th.U. per c.ft., all retorts being at work, is about 12½ million c.ft. per week. Allowing for idle retorts during scurfing, this figure is reduced to about 11 million c.ft., or rather less than 50,000 therms, for an average week.

The horizontal plant consists of seven beds of ten retorts, each retort 20 ft. long, through, and 18 in. by 24 in. D section. Double ascension pipes and hydraulic mains are fitted.

The yield with an average of 14 cwt. charges of twelve hours' duration is in the neighbourhood of 1,252,000 c.ft. of 520 B.Th.U. per c.ft., or about 6,500 therms per week per bed. Scurfing has to be allowed for every 15-20 weeks, but it is usually possible to utilize the reduced gas consumption during holiday time to perform this duty.

The C.W.G. plant consists of one Humphreys & Glasgow set of a nominal capacity of 1¼ million c.ft. of gas of 450 B.Th.U. per day. Actually, allowing for clinkering periods, a yield of 840,000 c.ft. of 450 B.Th.U. gas or 800,000 c.ft. of blue gas can be relied upon per day. This corresponds to about 3,800 therms per day on carburetted water gas or 2,300 therms per day on blue gas. This plant includes besides the back-run water gas set, a relief holder of about half-a-million c.ft. capacity, a set of two steam driven exhausters, each capable of passing up to 60,000 c.ft. per hour, a set of purifiers, and a separate meter.

It is seen that to meet the demands of the winter months it will be necessary to work the vertical plant, and at least part of the horizontal plant together. When summer approaches, however, the alternative presents itself of either working the vertical plant alone, steaming sufficiently to produce gas at 450 B.Th.U. per c.ft., or working the horizontal plant, and diluting the gas produced with blue water gas.

In the first case, peak loads will be taken by the C.W.G. plant producing gas of 450 B.Th.U. quality, oil for carburetting being used, and in the second case blue gas being produced for dilution would be carburetted only sufficiently to allow a larger proportion of this gas to be used in the mixture. It has been our practice in the past few years to use the vertical plant alone during the summer months, peak loads being taken by the C.W.G. plant as outlined above. This last year, however, the vertical plant became due for repairs, and consequently the horizontal plant had to be used in conjunction with the water gas plant. The dilution of the straight coal gas from the horizontals by means of low quality gas from the retort producers was not considered, as the increased inert content in the gas would have necessitated readjustment of apparatus in use by our consumers, due to the rise in specific gravity.

The experience gained during the summer months has enabled me to make a comparison of these two methods of gas production. A number of the factors involved apply to these particular works alone. These mainly refer to plant design, capacity, and layout. The other factors are common to all gas producers, and by making due allowance for discrepancies the comparison could be applied to any works.

Practical Consideration of the Two Methods of Gas Manufacture.

With the vertical retorts no difficulty has been experienced in maintaining the desired quality and quantity of base load gas required during the summer months. The fact that variations in output can be made by use of the C.W.G. plant has certainly enabled the vertical plant to be run at maximum efficiency. The average weekly thermal capacity of this plant is shown to be 50,000 therms. This, together with the C.W.G., gives a total maximum capacity of 76,000 therms per week. Thus, as the gas produced may be varied by over 50%, the plant is ample for the present load, and when used with C.W.G. in this manner a normal variation can be met with ease.

The amount of blue gas made in vertical retorts is controlled by regulating the admission of steam to the retorts. Thus the calorific value, which is dependent on the amount of blue gas in the mixture, is only indirectly controlled, as the quantity of blue gas produced is dependent on the amount of steam decomposed, and not necessarily on the amount admitted. Years of experience have perfected this method of control, and the results obtained in practice are usually consistent. When, however, the blue gas is separately produced, it is possible to test and meter both gases before mixing. This gives direct control of calorific value, and any variation in either gas stream may be counteracted by the opposite variation in the other.

Comparative Costs of Production.

Gas was manufactured by means of mixing horizontal and blue water gas during the twenty-six weeks ended Aug. 24, 1933. Unfortunately it was only possible to meter the blue water gas and the coal gas separately for the first seven weeks of this period. For this reason the costs have been worked out over the seven weeks from April 1 to May 18, 1933, although the average carbonizing

results obtained over a longer period are more favourable to this method of gas manufacture. The improvement was due to elimination of faults in calorific value control, and improved working efficiency of both plants.

The period Oct. 5 to Nov. 16, 1933, has been shown for comparison, with the period when gas was produced by mixing horizontal and blue water gas. The reasons for this choice are:

1. The length of this period is the same.
2. Gas was produced entirely by the vertical retorts, except for the necessary peak loads C.W.G.

The fact that the vertical retorts were freshly repaired when this comparison was made certainly may have been in favour of this method of gas manufacture, but since that time even better results have been obtained, due mainly to the installation of the Arca vacuum regulator on the gas stream. On the other hand, the horizontal retorts were also freshly patched and pointed, so that the plant conditions may be considered to be reasonably similar.

Balance-sheets have been prepared from the carbonizing results for the two periods, only the costs and receipts which vary according to the type of plant in use being included in these figures.

The Cost of Coal has been taken as 20s. per ton into our sidings. This figure is near enough to the actual price to eliminate any error due to incorrect proportioning of costs.

Carbonizing Wages.—This figure has been taken from the wages analysis for the period under consideration, and includes wages of operators of coal handling plant, loco driver and shunter, telpher operators, and all stokers and machine men.

Maintenance and Wear and Tear of Plant.—This figure was the most difficult to estimate accurately, as the repairs have been done in varying amounts during the years the plant has been in operation. This, coupled with the fact that costs of materials and labour alter from time to time, make direct comparisons nearly impossible. However, as the method of arriving at the figure is the same in each case, and the two plants have been worked side by side over the whole of their life, the comparisons should not favour one more than the other. The cost has been split into two portions. First, the minor repairs carried out while the plant is in operation and during idle periods, but without structural alterations. Secondly, the major repairs carried out by contract or direct labour, and embodying partial or complete reconstruction. Only repairs to actual carbonizing plant have been included. The coal handling plant and telpher are common to both, and therefore the cost of their upkeep may be said to be equally divided between the two.

The result shows that the cost of repairs per ton of coal carbonized has been higher in the case of the horizontal plant than the vertical plant. No doubt this has been done due to the fact that the former plant has been used intermittently during the winter months only, whereas vertical plant has been used continuously throughout its life. For this reason, it will probably be more accurate when making this comparison if 1d. per ton is subtracted from the cost of the horizontal retort repairs (14·00d.) and added to the cost of the vertical retort repairs (12·75d.). This figure will represent the increase in cost of upkeep occasioned on the vertical retorts by intermittent working, and the decrease in cost of the horizontal retort repairs due to continuous working. The figures then become:

	d.
Estimated cost of vertical retort repairs per ton of coal carbonized	13·75
Estimated cost of horizontal retort repair per ton of coal carbonized	13·00

Repairs to Water Gas Plant.—During the year 1933, £225 7s. 5d. was spent in material for repairs to the C.W.G. plant. Taking labour in the same proportion as before, this makes the total cost of plant repairs of £563 7s. 5d. This figure includes all cost of repairs to the brick lining and chequer brickwork, steam and water connections, air blowing plant, and steam raising plant. No costs for major repairs have been incurred since this plant was installed, except the necessary material for the alteration of the plant in 1928 to the back-run system. It is therefore assumed that the rest of the plant will become obsolete before renewal is necessary.

During this year 50,520,000 c.ft. of gas was produced by the plant, so that the cost of upkeep is 2·67d. per 1,000 c.ft. of gas made.

Purification.—The cost of oxide purification has been averaged over the last three years, and gives a cost of 0·316d. per 1,000 c.ft. of gas.

The H_2S concentration at the inlet to the oxide purifiers has averaged 463 grains per 100 c.ft. of gas for normal working, but during the summer of 1933 when horizontal gas only was passing through the coal gas purifiers, this increased to an average of 538 grains per 100 c.ft. The H_2S concentration of the water gas averaged 175 grains per 100 c.ft. over the same period.

For the purpose of proportioning the cost of purification, it has been assumed that the cost varies directly as the concentration of H_2S. Thus the cost of purifying straight coal fas from the horizontals has been rated at:

$$\frac{0{\cdot}316 \times 538}{463} = 0{\cdot}367\text{d. per 1,000 c.ft}$$

Similarly the cost for water gas is:

$$\frac{0{\cdot}316 \times 175}{463} = 0{\cdot}119\text{d. per 1,000 c.ft.}$$

The cost for vertical gas of a quality of 450 B.Th.U. per c.ft. has been taken as the normal, 0·316d. per 1,000 c.ft.

Cost of Production of Blue Water Gas when Produced in C.W.G. Plant.

As the blue water gas was produced at the same time as the peak load C.W. gas, the cost had first to be estimated for the whole amount, and then proportioned afterwards. As is seen in the balance-sheet, the whole of the costs except that of gas-oil, which is peculiar to the C.W. gas, were entered, and from the total the cost per 1,000 c.ft. of blue gas was calculated. For this purpose coke was priced at 20s. per ton at the plant, and breeze dust for the water-gas boilers at 10s. per ton.

This last figure may be rather high for this commodity, as there is practically no sale for it in the ordinary way. The extra cost to the water gas process, however, will be accounted for by minor items in the working of this plant, such as ash removal and boiler cleaning, which have not otherwise been included. Wages, maintenance of plant, and purification have been estimated as outlined previously.

The total carburetted and blue gas passed through the meter was 26,096,000 c.ft., and during that period 13,740 gallons of oil were used. From an analysis of previous working of this plant, it was found that an average of 1·7 gallons of oil were used per 1,000 c.ft. of 450 B.Th.U. gas produced. From these figures it was estimated that 8,086,000 c.ft. of C.W. gas of 450 B.Th.U. per c.ft. was produced, leaving 18,010,000 c.ft. of blue gas used for mixing with the gas from the horizontal plant. Then, allowing 70 c.ft. of oil gas produced per gallon of oil used, 961,000 c.ft. of oil gas and 7,125,000 c.ft. of blue gas composed the peak load C.W. gas produced simultaneously with the blue gas used in the mixture. Thus, 25,135,000 c.ft. of blue gas were produced altogether, 7,125,000 c.ft. of this being used as carburetted gas, and the rest being used in the coal gas mixture. The first figure has been used in arriving at the cost of blue gas production, and the second has been used in arriving at the allowance for the cost of the peak load gas made and included in these figures.

Receipts.

Coke has been valued at 20s. per ton. No receipts have been included for breeze dust, as it is assumed that the cost of removal and general inconvenience will amount to as much as this fuel is worth. Neither have any receipts been included for ammonia, as the production of sulphate of ammonia is not at the moment an economical proposition. Fortunately, the ammoniacal liquor is being disposed of at no cost. Tar has been valued at 2½d. per gallon in each case, although for the purpose of producing the tar to the Road Board Specification, the horizontal tar, with its high specific gravity, should be superior to the lighter vertical tar. In practice no difference in price is made whatever the quality of the tar produced, providing the water content is kept below the penalty figure. This gives a great advantage to the continuous vertical retort process, as the tar yield per ton of coal is so much greater.

Allowance for Cost of Producing Blue Gas for Peak Load C.W.G.—As before mentioned, an allowance was made in the receipts for the cost of producing blue gas, which went to the manufacture of C.W. gas. This figure was estimated from the data already given, being 7,125,000 c.ft. at 9·93d. per 1,000 c.ft., or about £295.

Balance.—The debit balance of expenditure over receipts gives the net cost of production of the gas. This figure does not include all the costs incidental to gas making, but only those costs that are influenced by the type of plant in use. Thus such costs as exhausting, general works repairs, and supervision which remain constant whichever plant is used are not included. The difference between the figure in the two balance-sheets should then give the difference in cost of gas manufacture by the two methods.

Conclusions.

It has been shown that for these works there are two methods of gas manufacture available during times of reduced load—viz., by the continuous vertical retorts, and by combination of the horizontal plant and the water gas

plant. Each method has been shown to produce the desired quantity of gas of approximately the same composition, but there are several points in which one method gains advantage over the other.

Calorific Value Control.—The method of producing the coal gas and the blue water gas separately gives the great advantage in calorific value control that alterations in either stream can be corrected at once by an alteration in the proportion of the mixture. This is shown to give a very accurate control, enabling the gas to be sent out at nearly exactly the declared value. On the other hand, the continuous vertical retorts give a very consistent quality line when working properly, but any trouble, such as a hanging charge or an unsealed coke chamber door, will cause an alteration in quality which might be passed on to the district.

Ease of Technical Control.—The fact that two plants require attention instead of one renders the technical control of the production of the mixed gas rather more arduous than for the vertical retorts alone. In our case this is accentuated by the fact that the water gas plant is situated some distance from the retort house. On the other hand, vertical retorts require more technical attention, so that this is somewhat nullified.

Production of Naphthalene.—The naphthalene content of the gas entering the holders rose to an average of 13·8 grains per 100 c.ft. when working with the horizontal retorts, while the gas from the vertical retorts contains only five to six grains per 100 c.ft. It is our practice to spray the gas entering the holder with petroleum, and this has the effect of entraining some of the naphthalene at this point. This, however, did not entirely prevent us having some trouble on the district during the autumn, due to the extra naphthalene produced during the summer.

Cost of Production.—The factor which will have most influence on the gas engineer in his choice of plant, will be the cost of gas production by each method. The method of cost analysis used has shown the net cost of the mixed gas to be 2·7d. per therm, while that produced by the continuous vertical retorts is 1·91d. per therm. This gives a difference in cost of 0·79d. per therm in favour of the vertical retort process. It is unfortunate that a longer period could not have been taken for this comparison, because the average carbonizing results over the whole period were much more favourable to the horizontal and blue gas mixture than those for the period taken.

The maximum make of mixed gas per ton of coal carbonized was over 19,000 c.ft. as opposed to the average of 17,200 c.ft. for the period taken. If this figure could have been maintained throughout the seven weeks under consideration, the amount of coal used would have been $\frac{4{,}108 \times 17{,}200}{19{,}000} = 3{,}700$ tons, or about 408 tons less. Thus a saving of approximately £408 would have been effected on the cost of coal, with a corresponding reduction of about half this amount in receipts for residuals, making a net saving of about £200, or 0·15d. per therm. Thus the net cost of production even under those conditions would still be over ½d. per therm more than the cost of production by continuous vertical retorts. This increased cost is accounted for by three main items in the balance-sheet—*e.g.*, increased labour charges, extra cost of plant upkeep, and reduced receipts for tar. This may be summarized as follows:—

Horizontal and Blue Water Gas Mixture.

	£ s. d.	
LABOUR CHARGES—		
Carbonizing wages	835 12 3	
Proportion of C.W.G. wages, say	110 0 0	
Total	945 12 3	or 0·72d. per therm
PLANT UPKEEP—		
Horizontal carbonizing plant	223 0 0	
Proportion of upkeep of C.W.G. plant, say	210 0 0	
Total	433 0 0	or 0·33d. per therm
		1·05d. ,,
Less receipts for tar	403 15 0	or 0·30d. ,,
		0·75d. net

Verticals.

	£ s. d.	
LABOUR CHARGES—		
Carbonizing wages	750 8 6	or 0·49d. per therm
PLANT UPKEEP	249 0 0	or 0·16d. ,,
		0·65d. ,,
Less receipts for tar	756 10 0	or 0·49d. ,,
		0·16d. net
Difference, Horizontals—Verticals		0·59d. per therm

This shows that these three items alone amount to a

Balance-Sheet.—Net Cost of Production of Gas of 450 B.Th U. per C.Ft.

CONTINUOUS VERTICAL RETORTS.

Seven Weeks, Oct. 5—Nov. 16, 1933.

EXPENDITURE.	£ s. d.	Per Therm. d.	RECEIPTS.	£ s. d.	Per Therm. d.
1. Coal used, 4,351 tons at 20s. per ton at works	4,351 0 0	2·82	1. Coke available for sale, 1,768 tons 3 cwt., at 20s. per ton (including coke used in C.W.G.)	1,768 3 0	1·14
2. Wages—carbonization	750 8 6	0·48	2. Tar available for sale, 72,583 galls., at 2½d. per gall.	756 1 0	0·49
3. Maintenance of plant at 13·75d. per ton of coal carbonized	249 5 0	0·16	3. *Net cost of gas production*	2,935 0 6	1·90
4. Purification of gas at 0·316d. per 1,000 c.ft.	108 11 0	0·07			
	£5,459 4 6	3·53		£5,459 4 6	3·53

Gas made = 82,470,000 c.ft. = 371,000 therms.

MIXED BLUE GAS AND HORIZONTAL GAS.

Seven Weeks, April 1—May 18, 1933.

EXPENDITURE.	£ s. d.	Mixed Gas Per Therm. d.	RECEIPTS.	£ s. d.	Mixed Gas Per Therm. d.
1. Coal used, 4,108 tons at 20s. per ton at works	4,108 0 0	3·11	1. Coke available for sale, 1,449 tons 15 cwt. at 20s. per ton (excluding coke used in C.W.G.)	1,449 15 0	1·10
2. Wages—carbonization	835 12 3	0·63	2. Coke and breeze used in water gas plant 5a and 5b	587 18 0	0·44
3. Maintenance of plant at 13d. per ton of coal carbonized	222 10 0	0·17	3. Tar produced, 38,760 galls. at 2½d. per gall.	403 15 0	0·30
4. Purifying coal gas, 52,172,000 c.ft. at 0·367d. per 1,000 c.ft.	79 15 0	0·06	4. Allowance for cost of producing blue gas used in peak load, C.W.G. 7,125,000 c.ft. at 9·94d. per 1,000 c.ft.	295 2 0	0·22
	£ s. d.		5. *Net cost of gas production*	3,550 10 6	2·70
5a. Coke used, 482 tons 18 cwt. at 20s. per ton	482 18 0				
5b. Breeze used, 210 tons at 10s. per ton	105 0 0				
5c. Wages, C.W.G.	150 1 3				
5d. Maintenance of plant, 26,096,000 c.ft. at 2·67d. per 1,000 c.ft.	290 6 0	Cost of blue gas production			
5e. Purifying 26,096,000 c.ft. at 0·119d. per 1,000 c.ft.	12 18 0				
5. Net cost of producing 25,135,000 c.ft. blue gas	1,041 3 3	0·79			
= 9·94d. per 1,000 c.ft.	£6,287 0 6	4·76		£6,287 0 6	4·76

Total mixed gas made = 70,582,000 c.ft. = 317,000 therms.

difference of about 0·6d. per therm in the cost of the two methods of manufacture.

There is no doubt that from the results obtained the continuous verticals produce cheaper gas than the horizontal and blue gas mixture, although such factors as the nature of the coke produced must also be taken into consideration, when deciding the merits of either method. During the last few years the requirements of our coke market have altered from the hard coke that was in use for industrial purposes to a light free-burning coke suitable for domestic open fire use. Thus, although a proportion of the horizontal coke can be sold without difficulty, certain of our customers will not buy any but coke from the vertical retorts.

This factor was largely instrumental in our deciding to take rather an unusual step during the summer of 1931. In this year the linings of the internal producers of the vertical setting were due for renewal. In the normal course of events, this plant would have been dropped, and gas manufactured by the method of mixing blue gas and gas from the horizontal plant, but it was decided, in view of the state of the coke market, to re-line each of the generators in turn, while maintaining the retorts at as near working temperature as possible. It was found that after emptying each of the four retorts in a bed, and sealing all dampers, plug holes, &c., there was sufficient time to remove the old lining and rebuild a new one without losing colour in the combustion flues. This re-lining of the producers allowed us to work the plant for a further 2½ years, saving on the cost of gas production, and reducing disorganization of our coke trade.

This examination has shown that our present policy of putting the horizontal plant out of commission during the summer months is the right one. Although gas may be manufactured and supplied of a similar composition and the same calorific value by use of this plant in conjunction with the water gas plant, manufacturing costs are higher, and consequently on this account alone can be ruled out as a normal method of gas manufacture. It is, however, a method which can easily be used during such periods as are necessary for the repairs of the vertical plant, and if care is taken, the extra cost of production can be kept down to about ½d. per therm.

Discussion.

The PRESIDENT (Mr. J. H. Wainwright) thanked the author for his paper, to which he said he had listened with much pleasure. He also welcomed to the meeting Mr. F. Davies, the Engineer of the Walsall Gas Department.

In discussing the Paper he said that in view of the conclusions which had been come to at Walsall in reference to horizontal *versus* vertical gas, he was interested to recall Mr. Hawthorn's Presidential Address last year, in which he stressed the fact that to produce a gas of a calorific value similar to that at Walsall, greater efficiency was obtained by using horizontal retorts and mixing the gas with water gas from an outside source. He expressed surprise that the comparison did not come out more forcibly in view of the price of the coal, which he presumed was from Derbyshire. He would have thought it would have been better to have carbonized this medium quality fuel in horizontal retorts instead of verticals. He was not quite clear as to the specific gravity of the mixed gas as compared with the gas from the vertical retorts. He asked if Mr. Brockbank had found that the two gases mixed readily in the holder, or did they lie in strata. He thought it unfortunate that the price obtained for horizontal tar was not more than that for vertical tar, the former being, in his opinion, of higher value.

Mr. F. A. JENKINS (Leamington), in proposing a vote of thanks to Mr. Brockbank, said the author had explained very clearly the method adopted at Walsall for utilizing the two systems of carbonization. It was a problem which they were spared at Leamington, where they used verticals only. He congratulated the author upon such a complete set of figures.

A vote of thanks was seconded by Mr. S. K. HAWTHORN (Birmingham), who said that the question of the comparative cost of two different types of carbonizing plant was a difficult one, and the paper covered a wider field than was indicated by the title. The difference in the cost of the two systems of carbonization was very marked, and, personally, he thought the author had painted too black a picture in regard to carbonizing in horizontals *plus* carburetted water gas. From the figures given he presumed the calorific value of the water gas was very low, and the water gas plant carried a rather heavy proportion of the costs.

The question of maintenance and wear and tear of plant was an important one in assessing the cost of different methods and was one very difficult to estimate, but Mr. Brockbank seemed to have dealt with the matter very fairly. He agreed with the author that it was easy to control the calorific value when using water gas and horizontal gas. In his opinion, where water gas was required all the time, one machine only as a stand-by was hardly sufficient margin.

Mr. W. MACNAUGHTON (Wolverhampton) thought the figure given for the production of blue water gas was on the low side. He noticed that Walsall were using an "Arca" vacuum regulator, and he asked if this gave better results than an up-to-date bell type governor.

Mr. E. ARTHUR (Birmingham) said he was at a works where horizontal gas and blue water gas were made, and he agreed with Mr. Hawthorne that the author had painted rather too dark a picture in regard to horizontal retorts. At Birmingham they were able to control the mixture of gas to 6 B.Th.U. up or down, and their cost of manufacturing blue gas averaged 2d. per therm, which was lower than the Walsall figure.

Mr. F. BENGOUGH (Birmingham) asked if any attempt was made to keep separate the tar from the vertical and horizontal plants, and if not, was any trouble experienced. Also if the author had considered using horizontal coke in the vertical plant producers and so release more vertical coke for sale.

Mr. A. W. ATTWOOD (Coventry) said he noticed the cost of the telpher had been charged equally to the two plants. In his opinion, more of the cost should have been borne by the vertical plant.

The Author's Reply.

Mr. BROCKBANK, in his reply, referring to the figures quoted in regard to the comparative costs of horizontal and vertical gas, said he had no axe to grind in the matter and had given the figures just as he had found them. They did not use the water gas plant as a carburetted water gas plant more than necessary to meet peak loads.

He was unable to give any actual figures in regard to the specific gravity of the mixed gases, but he did not think that the difference in specific gravity between the mixture and that of the vertical gas would be sufficient to cause any trouble.

They had not found that the water gas lay in strata in the holder.

With regard to the "Arca" regulator, they had obtained better results since its installation, but he was not prepared to say whether similar results would have been obtained with an up-to-date bell type governor.

The figure of 2d. per therm for blue water gas mentioned by one of the speakers was obtained upon a larger plant designed to produce blue gas only, which should give better results than the plant at Walsall, which was designed for both blue and carburetted water gas.

Consideration had not been given to the use of horizontal coke in the vertical producers, and as far as Walsall was concerned he did not think the extra cost of handling would pay them.

No trouble had been experienced due to the mixture of horizontal and vertical tar emulsifying.

With regard to the coal handling plant, this cost had been excluded, as the amount of coal used in each case per 1,000 c.ft. of gas produced was approximately the same.

Private Bills for 1934-35

We conclude below our summary of the clauses in Private Bills to be introduced in the 1934-35 session which affect gas interests.

Burnley.

The Bill is to extend the boundaries of Burnley, and in Clause 34 power is taken to extend the gas limits for the Corporation supply to include the new areas.

[*Agents: Sharpe, Pritchard, & Co.*]

Hoylake.

The Bill seeks, *inter alia*, to "confer further powers on the Council with regard to their gas, water, and electricity undertakings."

Clause 93 enables the Council to compel repairs to any pipes of appliances in case of danger, and to enable the Council to cut off supplies if the consumer fails to carry out the works.

Clauses 94 and 95 deal with the inspection and reading of meters. Clause 96 provides that the position of the meter in any new installation shall be placed as near as practicable to the Council's gas main but within the outside wall of the building.

Clause 97 enables the Council to cut off supplies if gas is improperly used, and Clause 100 enables the Council to supply gas to any house partly within their limits.

[*Agents: Sharpe, Pritchard, & Co.*]

Campbeltown.

To enable the town, *inter alia*, to borrow further money for their water and gas undertakings.

In Clause 6 the town seeks to borrow £4,000 for cooking and heating appliances and meters in connection with the gas undertakings of the Corporation.

[*Agents: Martin & Co.*]

Experiences with Breeze-Burning Producers

A Paper read before the Scottish Junior Gas Association (Western District) on Dec. 8, 1934.

By J. BATEMAN, of Kilmarnock

I chose the subject of breeze burning in producers because, judging from our experience at Kilmarnock, I believe that producers designed for this purpose will in the near future gain wide popularity. Such producers not only enable considerable financial savings to be made, but, as they work under pressure, they also give the technical operator a control over the heating of the modern retort setting which is closer than that he can at present attain with the open step-grate producer.

Generally speaking, coke breeze may be defined as that proportion of the coke made which will pass through a ¾-in. mesh. In most gas-works the usual method of disposing of this fraction has been to use it as fuel for steam-raising purposes, and there is no doubt that coke breeze properly utilized makes a very efficient boiler fuel. But the advent of the modern induced-draught waste-heat boiler, entailing in most cases the complete shutting-down of one works boiler, has resulted in a large reduction in the works demand for boiler fuel, and has left a large amount of fuel of low selling value for disposal.

The disposal of surplus breeze is not, in most cases, an easy matter at any time, but to find a ready outlet for it all the year round is still more difficult. Surely the ideal solution is to gasify this fuel in the producers and so release an equivalent weight of large coke for sale at a considerably higher price per ton than could be realized on the breeze.

The gasification of coke breeze of grade ¾ in.-0 in. alone is certainly practicable, but this fraction is only about 12% to 15% of the total coke made—that is to say, it is insufficient to fulfil the requirements of the producers, which consume from 25% to 28% of the total coke made. The small coke under 1 in. should, therefore, be included with the breeze fraction, and it may even be necessary to include coke up to 1⅛ in. or 1¼ in. grade before satisfying the producer requirements. A homogeneous mixture is essential, and may be assured by screening out the whole of the fraction required on one screen of the coke grading plant and then removing all dust under ⅛ in. It is desirable that this dust be removed, as it is high in ash content, tending to increase the formation of clinker in the producer, while a proportion of it may be carried forward in the producer gas and deposited in the combustion chambers.

Description of the Plant.

The gas-making plant at Kilmarnock consists of three settings of Glover-West vertical retorts comprising twenty-four 50-in. "steaming" retorts arranged in units of four. The settings are heated by three breeze-burning producers interconnected by a common flue, and of such capacity that any two producers can supply the full fuel requirements of the twenty-four retorts. It is from the operation of these producers over a period of two years that the information set out in this paper has been acquired. The sketch, fig. 1, indicates in cross-section the arrangement of the producer. The producers are of the step-grate type, and conform generally to the usual Glover-West design, the back walls being continuous with the front wall of the setting. The only difference in the grate from that of the open producer is a slight modification in the plates to suit the size of fuel used. The step-grate is enclosed by an air-tight wrought-iron door, and a Meldrum steam-air blower is arranged at one side. Gauges are fitted to indicate at a glance the steam pressure, the pressure in front of the grate, and the pressure in the producer gas uptake. The temperature of the steam-air mixture is shown by a steel-tube mercury thermometer. In the fitting of this instrument care must be taken that the flexible capacity tube has no sharp bends and is not twisted or flattened in any way.

Fuel.

The coke breeze and smalls required for the producers are separated out on the same screen of the grading plant, and all dust under ⅛ in. is removed. The fuel is then fed to the producer charging skip by means of a band conveyor which extends from the bottom of the breeze hopper to the producer charging stage. Excess breeze and smalls are used in the one Lancashire boiler, which is kept under slow fire in case of emergency. The average sizes of the fuel are as follows:

	%
Under 1½ in. and over 1 in.	30
" 1 " " ¾ "	29
" ¾ " " ⅛ "	41
	100

The percentage over 1 in. is perhaps somewhat high, but in our particular case it is necessary to meet the fuel requirements of the producers and provide a surplus for the Lancashire boiler.

Moreover, at Kilmarnock we have very little sale for fuel below the 1¼ in. grade, and it is therefore convenient to consume all the small fuel on the works.

In the writer's opinion a fuel containing 25% of 1 in. to ¾ in. and 75% under ¾ in. could be gasified at least as

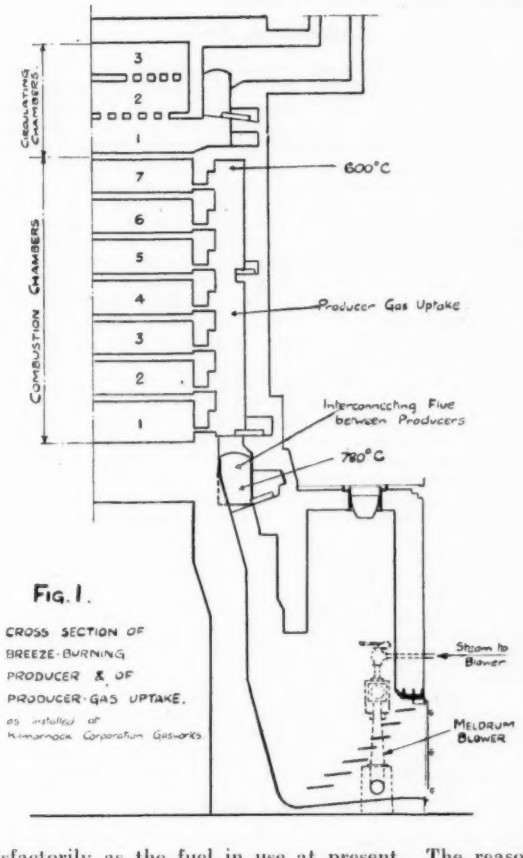

FIG. 1.

CROSS SECTION OF BREEZE-BURNING PRODUCER & OF PRODUCER-GAS UPTAKE. as installed at Kilmarnock Corporation Gas-works

satisfactorily as the fuel in use at present. The reasons for the removal of the dust under ⅛ in. have already been given. Several samples of this dust were taken and found to contain as much as 23% of ash. There can be no advantage in using the producer as a destructor merely to get rid of a part of this unwanted material.

Charging.

The producers are charged every four hours, the working time-table being so arranged that each producer receives a charge one hour before it is due for cleaning. This ensures that there is no possibility of the level of the fuel bed falling below the curtain wall arch during cleaning.

The fires are cleaned every twenty-four hours, with a prick-up at the twelve-hour interval.

It is quite unavoidable to remove a certain amount of coke along with the ash during cleaning, in addition to the coke which may adhere to the clinker itself. The amount of loose fuel removed with the ash depends a great

deal upon the competence of the operator. At Kilmarnock the amount of carbon in the ash as removed is never more than about 2½% of the fuel used in the producers.

Control of Breeze-Burning Producers.

The main points at which to aim in the control of breeze-burning producers are:

(1) Suitable flare bed temperature.
(2) Minimum clinker.
(3) Maximum time contact between the steam-air mixture and the fuel bed.

The temperature of the fuel bed and the formation of clinker go hand in hand. At the commencement of operations in Kilmarnock some difficulty was experienced with the formation of clinker on the back wall of the producer and above the door lintel. The grate area was reduced by bricking up the two top grate plates, and this was found to reduce very considerably the formation of clinker above the lintel. The end bricks above the two plates are left loose so that they may be easily removed, and on the principle that prevention is better than cure, the bricks are taken out once every month and a curved rod inserted to feel above the lintel for signs of clinker formation. At the same time a long rod is pushed right through the fire to the back wall, and care is taken to feel with a rod along the side walls. These rods are marked so that there is no danger of damage to the brickwork at the back of the producer. Since adopting this method and obtaining the correct setting of the air-steam ratio, we have experienced no trouble with clinker formation.

Air-Steam Ratio.

When commencing operations it is best to set the air slide on the inlet to the Meldrum blower about one-third open and regulate the steam valve to give the amount of producer gas required for heating the setting. Strict attention to cleaning, observation of the nature and quantity of the ash and clinker removed, and observation of the CO and CO_2 contents of the producer gas enable adjustments to be made gradually on the air slide and steam valve until the maximum CO content in the producer gas is obtained consistent with minimum clinker formation.

The necessary time contact between the steam-air mixture and the fuel bed is assured by keeping a steady pressure in the producer gas uptake. As the size of fuel affects the time of contact for a given weight of fuel, on account of the relatively larger surface area of smaller pieces, it is desirable to keep the fuel sizes as regular as possible. It will be readily understood that on this score a definite advantage can be claimed for screened breeze over unscreened coke. At the same time, although segregation does not occur with screened breeze to the same extent as with unscreened coke, it is an advantage to have a simple spreading arrangement at the charging door. The pressure at the bottom of the producer gas uptake is kept at one-half tenth inch water gauge, and this increases to 2 tenths at the top of the uptake. Apart from its influence upon the quality of producer gas, a distinct pressure in the uptake is found to give much better control over the heats in the combustion chambers.

As already stated, the producers are interconnected by a common flue. This is invaluable in allowing one producer to be shut down and another started up in its place without interfering with the settings which are working. But it is found that during and immediately after cleaning the common flue does not exert as great an influence as might be expected. The producer gases do not mix to any appreciable extent, and the heats of a setting vary with the quality of the gas from its own producer.

Working Conditions.

The following are the working conditions which we have found to give the most satisfactory results:

Steam pressure to blowers	= 50 lbs. per sq. in.
Steam notches on 1½ in. valve (Max. = 12)	= 7
Air slide opening	= 1⅝ in.
Temperature of steam-air mixture	= 140° F. (60° C.)
Pressure in front of the fire	= 3/10ths W.G.
Pressure in producer gas uptake	= 5/10ths ,,

No. 1 and No. 2 settings are in operation and are heated by No. 1 and No. 2 producers.

Reference Number (see Fig. 1), Temperature.

		°C.
Circulating Chambers	3	1,080
	2	1,150
	1	1,220
Combustion Chambers	7	1,300
	6	1,310
	5	1,310
	4	1,300
	3	1,300
	2	1,280
	1	1,240

In January, 1934, a test under normal working conditions was carried out on the gas-making plant, and the figures which bear relation to the producers are appended.

RESULTS FOR FOUR WEEKS ENDED JAN. 27, 1934.

TABLE 1.—*Carbonizing Results.*

Gas made	= 33,704,500 c.ft.
Coal carbonized	= 1,483 tons
Gas made per ton of coal carbonized	= 22,727 c.ft.
Therms made per ton of coal carbonized	= 93·48 therms
Calorific value of gas made	= 411·3 B.Th.U.
Coke made	= 783 tons
Coke made per ton of coal carbonized	= 10·6 cwt.
Fuel to producers	= 245 tons
Percentage of producer fuel on the basis of coal carbonized	= 16·5%
Percentage of producer fuel on the basis of coke made	= 31·3 ,,

TABLE 2.—*Figures Relating to Coke Made and Producer Fuel.*

Saleable coke above 1¼ in.	= 460 tons
Screened breeze ¼ in. to 1¼ in.	= 291 ,,
Dust under ¼ in.	= 32 ,,
	783 ,,

Hand Grading of Coke as Made.

	%
Over 2 in.	= 30
1½ in. to 2 in.	= 30
1 in. to 1½ in.	= 11
¾ in. to 1 in.	= 11
⅜ in. to ¾ in.	= 14
Under ⅜ in.	= 4
	100

Hand Grading of Screened Breeze.

	%
1 in. to 1¼ in.	= 30
¾ in. to 1 in.	= 29
½ in. to ¾ in.	= 17
¼ in. to ½ in.	= 16
⅛ in. to ¼ in.	= 8
	100

Proximate Analysis.

—	Coke as Made.	Saleable Coke.	Screened Breeze.
Moisture	2·0%	1·7%	1·8%
Volatile organic matter	2·5 ,,	2·3 ,,	2·7 ,,
Ash	10·3 ,,	6·7 ,,	7·2 ,,
Fixed carbon	85·2 ,,	89·3 ,,	88·3 ,,
	100·00	100·00	100·00
Calorific value in B.Th.U. per lb.	12,750	13,320	13,240

TABLE 3.—*Figures Relating to Ash from Producers.*

Average fuel to each producer per 24 hours	= 4 tons 7 cwt.
Average ash removed from each producer per 24 hours	= 17 cwt.
Percentage of ash to fuel	= 19·5%

TABLE 4.—*Waste Heat Boiler.*

Water evaporated	= 214,000 galls.
Water evaporated per hour	= 318 ,,
Water evaporated per ton of coal carbonized	= 1,443 lbs.
Actual evaporation per lb. of fuel to producers	= 3·9 ,,
Equivalent evaporation per lb. of fuel to producers from and at 212° F.	= 4·53 ,,
Temperature of steam leaving superheater	= 382° F. (194° C.)
Pressure of steam leaving superheater	= 100 lbs./sq. in.
Temperature of feed water	= 120° F. (49° C.)
Temperature of waste gases at inlet to boiler	= 700° C.
Temperature of waste gases at outlet from boiler	= 210° C.
Draught at inlet to boiler	= 5½ tenths W.G.
Draught at outlet from boiler	= 9 ,, ,,
Draught on the setting	= 3½ ,, ,,

Comments on the Results of the Test.

At first glance the amount of coke made per ton of coal carbonized might appear low, but it must be remembered that we are steaming in the retorts to produce a gas with a calorific value of 410 B.Th.U., the figure of 10·6 cwt. of coke being offset by an increased yield in gaseous therms per ton of coal carbonized. Similarly the percentage of producer fuel may appear high calculated on the basis of the coke made, but considered in relation to the amount of coal carbonized it is seen to compare favourably with percentages to be expected when using other grades of producer fuel. We find in practice that there is no difference in the percentage of fuel consumption when using screened breezes in place of unscreened coke to the producers. In the test quoted 13 retorts were in operation, which is 3 short of the full complement for two settings. With 16 retorts in operation an improved percentage fuel consumption would be obtained. Conversely during the summer months when only 9 retorts are in operation and the remaining 7 kept under moderate heat, the fuel consumption jumps up to 19 or 20%. We expect to get our extra summer fuel costs returned to us in the shape of longer life of the settings. Over a year's working the producer fuel averages about 17·5% of the weight of coal carbonized.

The coals carbonized are mostly from the Ayrshire coalfields. They are not of a highly coking nature, and this

fact, together with the amount of steaming in the retorts, accounts for the high percentage of smalls indicated by the hand-grading test of the coke as made, as shown in Table 2. The actual figures for the total saleable coke and screened breeze made during the test substantiate the hand-grading test.

It will be observed from the results of the hand-grading test that the screened breeze includes 8% of grade ⅛ in. to ¾ in., a fraction which in most places is discarded with the dust. The gasification of this small material in the producers represents a saving of about 15 cwt. of fuel per day. In the proximate analysis, as one would expect, the ash in the coke as made is considerably higher than in the screened breeze, this being due to the high percentage of ash in the dust which has been removed from the breeze.

Table 3 shows that the total ash removed from the producers is 19·5% by weight of fuel charged. Analysis indicates, however, that moisture, due to the water dripping from the grate plates and to the steaming of the producer, accounts for 28·5% of this ash. Carbon in the ash as removed amounts to 13%, representing 2·6% of the amount of fuel used in the producers. That is, out of a day's supply to each producer of 4 tons 7 cwt. of fuel, only 2¼ cwt. of useful material passes through the fire without being gasified.

A test on the producers is not complete without the results obtained from the waste-heat boiler, and these are given in Table 4. When the waste-heat boiler was first put into operation the evaporation per lb. of fuel to the producers was about 3 lbs. actual. Tests of the waste gases indicated infiltration of air into the waste gas flues from No. 3 setting, which is not in commission. The temperature of the gases at the boiler inlet was thereby being reduced to 450° C. The infiltration was successfully remedied and the temperature at the boiler inlet increased to 700° C. The actual evaporation is now 3·9 lbs. per lb. of fuel to the producers, and it is hoped to increase this figure by further preheating of the feed water.

Costs and Economies.

In estimating the saving effected by the utilization of breeze in the producers it is first necessary to ascertain the increase in operating costs for the pressure producer as compared with those for the ordinary open step-grate type. Labour costs for both types of producers are practically the same. The increase is, therefore, due mainly to the cost of steam to the breeze-burning producer. As the gas-making plant incorporates a waste-heat boiler which is capable of supplying the full steam requirements of the plant besides providing a surplus for works purposes, the cost of steam may be taken as the cost of waste-heat boiler steam. Neglecting capital costs, this works out at Kilmarnock to 4d. per 1,000 lbs. of steam, the main factor being the cost of electric current to the fan motor. The slight extra cost of electric current to the breeze band conveyor motor had also to be taken into account.

The increase in the operating costs of the producers due to their application for breeze burning may now be calculated as follows:

Steam to each producer (Allow one hour with steam off each day for charging and cleaning)	=	236 lbs./hour
Steam to both producers	=	10,850 lbs./day
Cost of steam per day	=	3s. 8d.
Cost of steam per annum	=	£67
Electric current per annum for breeze conveyor	=	3
Total increase in operating costs		£70
Saving in fuel—		
Value of unscreened coke	=	14s. per ton
Value of screened breeze	=	8s. 6d. per ton
Saving per ton of fuel	=	5s. 6d.
Saving on 3,000 tons per annum	=	£825
Deduct increase in operating cost	=	70
Net annual saving		£755

From these figures it is quite obvious that breeze burning in producers is a sound financial proposition. To the gas-works management faced with the problem of the disposal of large quantities of breeze at the usual low prices, the consumption of this low-grade fuel in their own producers offers a ready solution together with the opportunity for increased returns from coke.

Discussion.

The PRESIDENT (Mr. John Greig) said that it had been shown that the problem of the disposal of coke breeze could be solved. The problem was to find suitable producers for breeze burning, and it was correct practice to use breeze-burning producers in conjunction with continuous vertical retorts, as these were responsible for the production of a greater amount of breeze. He enquired how the dust screen worked and remarked that good efficiency would only be obtained using dry coke. The presence of dust was harmful because dust of ⅛ in. and under did not burn. He was interested in the proportion of the various sizes of coke used and suggested that the coke from 1 in. to 1¼ in., which was really coke nuts, was the most important part of the fuel. The use of this size in the producer would leave only two sizes of coke for sale at Kilmarnock, and this might prove an advantage if there were no consumers for the 1 in. to 1¼ in. size. He was interested in the shutting-off of steam during cleaning, and wondered if there was not sufficient coke to throttle the gas. He also asked about the setting of the producer damper and wondered if it was worked full open or throttled, his experience being that it was better to work throttled. One of the disadvantages of the step grate was that it was unavoidable that some of the coke should be removed in cleaning. The setting of the air-steam mixture was a most important point, as it controlled the temperature of the producer gas. He thought that it would be better to work all three producers at Kilmarnock, so that in cleaning one could be shut off while the other two were working. He suggested that the pressure under the bar was rather high, but considered that this might be necessary with the fine fuel used.

Mr. MCINTOSH (Kilmarnock) said that in the work described breeze mixed with coke of other sizes had been used, and he wondered if the producers had been tried with coke up to 1 in.

Mr. STEVENSON (Glasgow) enquired of what material the belt conveyor was made and what type of grader was used.

Mr. POULSON (West's Gas Improvement Company, Ltd.) said that as early as 1921 forced draught had been used on a producer at Kilmarnock, though this was not of the step-grate type. Mr. Bateman had said that producer working under pressure gave the operator greater control, and this really meant more flexibility. Flexibility was becoming more and more important. One of the main factors in the use of breeze burning producers was the saving effected by the consumption of coke which was generally unsalable. The exact value of this was difficult to assess, as it usually meant that a better price was obtained for the larger coke, and this had to be taken into account. In some producers breeze from ⅛ in. to ¾ in. was used, but in these cases there were three sets of dampers which were regulated to give an even setting balance. Cleaning was only necessary every 24 hours, and this was important, as it was desirable to disturb the fire as little as possible. Another advantage of this type of producer was that any size of coke could be used, the only alteration necessary being the regulation of the steam valve and air slide. Less dust was formed with forced draught than with the open hearth step grate producer.

Mr. R. A. MACLAREN (Newton-on-Ayr) asked how the price at which screened breeze was assessed had been obtained. He suggested that anthracite dust, of which there was a considerable quantity available in Ayrshire, might be suitable for use in the producers. He was rather surprised that the steam pressure was 50 lbs. per sq. in., because he had found that using steam above 10 lbs. pressure resulted in the flue being clogged with dust. Had they had a similar experience at Kilmarnock?

Mr. MILNE, B.Sc. (Greenock), asked what were the approximate outside dimensions of the producers, as he believed that a larger producer was necessary for breeze than for screened coke. With unscreened coke he had employed a steam pressure of 15 lbs. per sq. in., and when he added 40% breeze from ½ in. he had to increase the steam pressure to 100 lbs. per sq. in. to maintain an even pressure in the producer gas main. He asked if Mr. Bateman had a recorder fitted to register the producer gas pressure.

Mr. CAMPBELL (Helensburgh) remarked that from the point of view of net annual saving gas-works not having breeze burning producers were behind the times. He thought that the figure was not quite fair, because all gas-works operating producers did not have waste-heat boilers and coke graders, and he suggested that the capital charges on this additional equipment should be taken into consideration in assessing the net annual saving. Works which had no breeze could not effect this saving, and where there was no waste-heat boiler coke would be needed for steam raising.

Mr. J. WEBSTER (Port Glasgow) said that his was probably an isolated position, because he could obtain more for the size of coke which Mr. Bateman used in the producers than he could for larger sized coke. This, of course, was a local condition which did not apply to all gas-works. He asked how allowance for wear was made on the rods used for cleaning out clinker and enquired how the spreading arrangement at the charging door operated.

The Author's Reply.

Mr. BATEMAN, in reply, said that the dust was practically all removed from the breeze in the grader, which was of the reciprocating type. The coke was dry, and as the grader was under cover there was no moisture present to cause clogging. They had intended to use only coke under 1 in. in the producer, and though they had started using coke of this size and had found it satisfactory, they had not sufficient to keep the producers going. They had practically no sale for coke below 1¼ in., and had considered it better to use it in the producers. The reason for shutting off the steam while cleaning was that in using unscreened coke large clouds of dust formed when the gas was ignited on opening the door. Two dampers were fitted, one under the grate and one over. The one under was full open and the other one was regulated so that no air was drawn in. He thought that it was more advantageous to have two producers working at full capacity than three running under capacity. He did not consider the pressure in front of the fire, three-tenths W.G., high. There certainly was a slight back pressure with the fine fuel used. The band conveyor was made

of rubber and the coke travelled down the grader to the bunkers.

The value at which breeze was assessed depended on local conditions, and in his case, as he had said, there was no demand for coke under 1¼ in. size. He had no experience with anthracite dust, but did not think it would be advantageous if breeze was available. He thought that the dimensions wanted were probably those of the grate, and in his case the grate area was about 1 ft. per 10 lbs. of coke gasified per hour. There was a gauge fitted on the common main to record pressure and to indicate any leakage of air. As regards using a steam pressure of 50 lbs. per sq. in., he pointed out that practically all the dust was removed from the breeze before use, and in any case the pressure under the grate was only three-tenths. The flues and dampers were cleaned out every week when using unscreened coke and every three weeks with screened coke.

The net annual saving was dependent on local conditions, and if it was possible to get a good price for breeze then it should be sold. As regards the rods used for cleaning, they did not suffer much from wear, as with the amount of steam used there was no really hard clinker. The spreader at the charging door was simply a V shaped plate.

Legal Intelligence

Tenby Company Reduces its Capital.

In the Chancery Division, on Monday, Mr. Justice Eve granted the petition of the Tenby Gas Consumers' Company, Ltd., for confirmation of the reduction of its capital from £30,150 to £20,100.

It was stated by COUNSEL for the Company that the reduction would be effected by returning 1s. 8d. a share on 120,600 5s. shares by paying it out of cash in the hands of the concern. The amount returnable was in excess of the wants of the Company, which was incorporated in 1877 to take over the existing gas-works at Tenby. Subsequently, it began to supply electricity under an Order obtained in 1927. In 1931 the Company sold its interest in the electricity undertaking and now confined itself to gas production. An Order would be applied for for fixing the capital of the Company at £20,100.

After hearing an affidavit by Mr. Leach, the Chairman of the Company, his Lordship confirmed the reduction as stated.

Deputation to the Minister of Transport

In the Interests of Steam Wagons.

A deputation to the Minister of Transport was organized by the Coal Utilization Council on Dec. 12 to draw attention to the position in which steam road vehicles have been placed by the regulations limiting their weight when laden, and to urge the expediency, in the national interest, of so revising the regulations as to encourage their use and development rather than discourage them.

The following agreed statement was issued at the conclusion of the deputation:

The Minister of Transport received at the House of Commons to-day a deputation of representatives of interests concerned in the use of coal for road transport purposes, who laid before him for consideration suggestions for assisting coal-burning road vehicles by way of the relaxation of certain statutory restrictions.

The deputation, which was introduced by Mr. George Hall, M.P., and Sir Adrian Baillie, M.P., consisted of representatives of the Coal Utilization Council, the Mining Association of Great Britain, the Monmouth and South Wales Coalowners Association, the National Gas Council, and manufacturers and users of steam road vehicles.

The Principal Difficulty.

It was put to Mr. Hore-Belisha that the principal difficulty which was responsible for the decline in the use of steam road vehicles in recent years was that the enforcement of the regulations as to permissible total weights operated adversely to the steam road vehicle, and it was pointed out that in the consequent decline in the consumption of coal and coke was a serious matter for the Industry and particularly for the distressed area of South Wales.

Mr. Hore-Belisha asked for the production of figures which would enable him to make a detailed comparison of the positions of the coal-burning vehicle with its competitors and promised to give these figures his careful consideration.

1935 GAS SALESMAN'S POCKET BOOK

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South-Western Gas and Water Corporation

Increase of Capital Approved

At an Extraordinary General Meeting of the South-Western Gas Corporation held on Wednesday, Dec. 12, at 9, Clement's Lane, London, E.C., a special resolution was unanimously passed to change the name to the South-Western Gas and Water Corporation, Ltd., and an ordinary resolution was also unanimously passed to increase the capital to £1,500,000 by the creation of an additional £300,000 4½% redeemable cumulative preference shares and £600,000 ordinary shares.

Mr. S. J. INGRAM, the Chairman, in his Address, said:

Gentlemen,—There is little I can add to the letter addressed to the shareholders under date Nov. 19, 1934, explaining the reasons for the matters which are before you to-day for your consideration.

Your Directors are unanimous in their recommendation that significance should be given in the name and style of the Corporation to the fact that we are substantially interested in water undertakings, as such acquisitions give strength, both as to maintainable income and, it may be said, general credit, to the Corporation. If one were to offer an opinion as to the security for the investment of funds, it might be that gas and water, being public services and required by almost every householder in the country, form a basis of sound security and, with efficient management, permanent income.

The present authorized capital of the Corporation is £600,000. This is divided into 200,000 of 4½% redeemable preference shares and 400,000 of ordinary shares, both of £1 each. At this date there is issued £89,809 of preference shares and £372,259 of ordinary shares. In addition to the share capital issued, there is outstanding £110,000 of 4% debenture stock. From this statement you will gather that excluding the preference share capital there remains in the treasury only 27,741 of ordinary shares of £1 each.

The Corporation has now acquired 19 gas and water undertakings within the boundaries of the area originally contemplated and forming the south-western district. Within this area we are at the present moment negotiating with a number of other companies, and it is advisable therefore to prepare for further capital requirements of your Corporation.

It is satisfactory to note that approximately 40% of the shareholders in the undertakings which have been acquired to date have exchanged their shares for shares in the Corporation.

The policy of the Corporation from its inception has been to acquire undertakings in the south-western area, which, for the purpose of co-ordination, are formed into groups. These groups operate under the technical direction and administration provided by the Corporation and under the general supervision of the Board of the Corporation. Our ultimate object will be so to arrange manufacture and distribution to the best advantage of each of the individual undertakings acquired that the customers will benefit in reduction of cost of gas or water and better service.

Wherever we have acquired undertakings we have sought to retain the local interest, associations, and personnel, and to leave undisturbed the existing local conditions so far as is consonant with the Board's policy of co-ordination. In every case we have invited local Directors to remain on the Board with the addition of representatives of the Corporation, and in many instances the Chairman of the Board and his colleagues have agreed to continue as representatives of the Corporation.

The Board's policy will also definitely improve the status of the permanent officials by means of pensions funds and other like arrangements for which we are making provision.

You will all agree that it is too early in the history of the Corporation to deal at any length with the economies which, as a result of co-ordination, have accrued to the subsidiary companies. Economies are being achieved and should, in time, be reflected in the accounts of the individual companies, enabling the consideration of a revision in the price of gas and at least the maintaining of the dividends heretofore paid by the separate undertakings.

Low Temperature Carbonisation, Ltd.

Large Expansion in "Coalite" Sales

The Annual General Meeting of Low Temperature Carbonisation, Ltd., was held on Dec. 14 at Southern House, Cannon Street, E.C., Col. W. A. Bristow, M.I.E.E., F.R.Aë.S, (Chairman and Managing Director), presiding.

The CHAIRMAN said: Ladies and gentlemen,—The profit on the trading account with interest and dividends from our subsidiary Doncaster Coalite, Ltd., amounts to a total of £87,286. Last year the figure was £60,820 and for the previous year £49,828. This continued increase is all the more noteworthy having regard to the fact that the only increase in plant during the period consisted of the fifth and sixth batteries of retorts erected at Askern in 1932. These results have been achieved largely by improving the rate of throughput and the overall efficiency of the "Coalite" process. In addition, as the advantages of your Company's oil products have become better known, their selling prices have steadily improved.

The premiums paid on these conversions amounted to £24,294, and as these operations were in the interest of the ordinary shareholders, your Directors consider it proper that this sum shall be written off, and it is proposed, therefore, that this year one-third shall be so treated. In addition, it is proposed to write off the expenses of issue of the 3,000,000 ordinary shares amounting to £5,985.

The proposed dividend of 3% is only small, but it was hardly expected that a dividend could have been paid at all until the new works were in operation.

The extensions and the new works will enable the capacity of the plants to be raised from an annual throughput of 220,000 tons of coal to about 560,000 tons. This will greatly increase the total profits and there will be no further standing charges in front of the ordinary capital.

One of the most striking features of the business of your Company is the increasing national necessity for everything it produces.

At the risk of appearing annually wearisome, I must once more repeat that the demand for "Coalite" continues to expand at an ever-increasing rate, and this expansion is due solely to the excellence and economy of the fuel itself. The work of the Smoke Abatement Society, Medical Officers of Health, and other bodies throughout the country is undoubtedly having a considerable effect upon the mind of the public, and this Company follows upon their heels offering to the converted ever-increasing supplies of the most perfect smokeless fuel in the world. At present "Coalite" and "Metro-Coalite" form almost 100% of the fuel manufactured in this country to-day by the process of low-temperature carbonization, and there is no indication that this percentage will be materially altered.

Your Directors are familiar with the details of the schemes recently announced, and, speaking with a due sense of my personal responsibility in this matter, I have no hesitation whatever in stating that your Company's process for the manufacture of smokeless fuel, and petrol and oil, from coal is not, in the remotest degree, challenged by any of the processes of which you have recently heard.

There is, however, a new factor which is having a most beneficial effect upon the fortunes of the Company, and that is the increasing use of oil in almost every branch of engineering. When the late Mr. Thomas Parker took out his first patent for low-temperature carbonization coal was pre-eminent as a source of power. The Navy and Mercantile Marine ran almost entirely on coal, the number of oil-fired land installations was negligible, the Diesel engine was hardly out of the nursery and of the high-speed Diesels there were none. Diesel locomotives had scarcely been thought of and there were no Diesels on the road. Since that time the advance of the internal combustion engine using heavy oil, and the use of oil for steam raising, has revolutionized engineering practice, and the change-over from coal to oil continues to-day on an extensive scale.

We have for the first time in history produced from coal aviation petrol and naval fuel oil. Nine home defence squadrons of the Royal Air Force have been running on coal petrol made by this Company and refined and distributed by Messrs. Carless Capel & Leonard. At the last Air Force Pageant over eighty of our finest fighting machines were flying on our coal petrol. In addition to the fuel oil supplied to the Navy, large quantities have been used by railways and important industrial undertakings, and the foundations of this new industry have been well and truly laid. There is also every reason to believe that the Diesel oil which your Company is preparing to manufacture on a commercial scale will be equally as successful as the fuel oil and petrol.

Your Company has both the ability and the confidence necessary to enable it to remain in the forefront of this great national movement, and I feel sure that in our time we shall witness an enormous advance in the industry which we have created. Few would have deemed possible the progress that has been made in the past few years. Your Directors are, however, inspired by something higher than the making of so many tons of fuel or gallons of oil. We have concentrated for years on the far more important problem of making a commercial and economic success of the process and adapting and harnessing it to our great national needs. We are deeply sensible of the warm-hearted manner in which the public rejoice at our success, and we shall continue to apply ourselves with unabated zeal to the great task to which we are committed.

The report and accounts were unanimously adopted, and the proceedings terminated with a vote of thanks to the Chairman, Directors, and staff.

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check zero . . . .

turn on cock. . . .

adjust needle valve—

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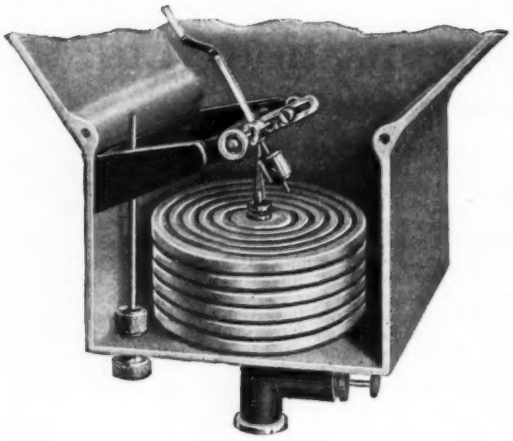

THE REASON IS THIS:

. . . the use of metallic diaphragms, properly constructed, in conjunction with the 'Dead-Beat' system of transmission and control, *and because no liquids are used.*

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of pressure measurement
is so sensitive
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Gas Markets and Manufactures

Stock Market Report.

[For Stock and Share List, see later page.]

The last account of the year closed on Friday last, and though there was a certain amount of liquidation in preparation for end-of-the-year balance-sheets, prices were not materially affected. The new Account opening this week is one of the three-week variety and includes the Christmas recess, so that no exceptional activity is anticipated. There is a hopeful optimism, however, that brighter conditions will commence again with the New Year. A feature of the week was the renewal of strength in British Funds, attributable to a large extent to the Chancellor of the Exchequer's statement regarding the Government's monetary policy, and, headed by India 3% with a gain of 40s., each one of these stocks appreciated.

The volume of business in Gas stocks and shares showed no signs of slackening off, the number of recorded transactions being much the same as the previous week, and, with two exceptions, only price movements were on the upgrade. A noteable feature is the strength of Wandsworth 5% debenture stock, which hardened 7 last week to 134½, the highest price of any 5% debenture in the List, while business was recorded at 135. The yield at this price, which at the time of writing includes a full half-year's interest, works out at £3 14s. 4d.%. It will be seen in the Stock and Share List that several other 5% debenture stocks also appreciated, including Croydon to 127½ and South Suburban to 129½. It appears evident that the Government's policy with regard to the maintenance of cheap money rates will tend to lower still further the return on this class of investment. The two reactions referred to above were Gas Light units which eased 3d. to 28s. 3d., and South Metropolitan ordinary with a drop of 2 to 150½.

At an extraordinary general meeting of the South-Western Corporation, Ltd., held last week a special resolution was passed to change the name of the Corporation to the South-Western Gas and Water Corporation, Ltd. At the same meeting it was agreed to increase the present authorized capital of £600,000 to £1,500,000 by the creation of an additional £300,000 4½% redeemable cumulative preference shares and £600,000 ordinary shares. The Corporation has already acquired 19 gas and water undertakings in the South-Western area, and as negotiations are now pending with a number of other companies the increase in capital was considered necessary. The Chairman stated that approximately 40% of the shareholders in those undertakings already acquired to date had exchanged their holdings for shares in the Corporation.

Current Sales of Gas Products.

The London Market for Tar Products.

Dec. 17.

Current prices of tar products are as follows:

Pitch, 48s. to 49s. per ton f.o.b.

Creosote is firm at 4½d. to 4⅝d. per gallon in bulk at makers' works.

Refined tar, 4d. to 4¼d. per gallon in bulk at makers' works.

Pure toluole, about 2s. 2d.; pure benzole, 1s. 9d. to 1s. 10d.; 95/160 solvent naphtha, 1s. 7d.; and 90/160 pyridine, 6s. 3d. to 6s. 6d.—all per gallon naked at makers' works.

Tar Products in the Provinces.

Dec. 17.

The average prices of gas-works products during the week were: Gas-works tar, 21s. 6d. to 26s. 6d.; Pitch—East Coast, 47s. 6d. to 50s. f.o.b. West Coast—Manchester, Liverpool, Clyde, 47s. 6d. to 50s.* Toluole, naked, North, 1s. 6d. to 1s. 8d. Coal-tar crude naphtha, in bulk, North, 6½d. to 6¾d. Solvent naphtha, naked, North, 1s. 4d. to 1s. 4½d. Heavy naphtha, North, 9¾d. to 10¾d. Creosote, *ex* works, in bulk, North, liquid and salty, 3½d. to 3⅝d.; low gravity, 3½d. to 3⅝d.; Scotland, 3⅝d. to 3⅞d. Heavy oils in bulk, North, 3¾d. to 4¼d. Carbolic acid, 60's, 1s. 8d. to 1s. 9d. Naphthalene, £10 to £11. Salts, 55s. to 75s., bags included. Anthracene, "A" quality, 2½d. to 3d. per minimum 40%, purely nominal; "B" quality, unsalable.

* All prices for pitch are now quoted on the basis of f.o.b. In order to arrive at the f.a.s. value at any port it will be necessary to deduct the loading costs and the tolls whatever they may be.

Tar Products in Scotland.

GLASGOW, *Dec.* 15.

Little or no change has taken place in market conditions during the week. Quotations are mainly steady.

Crude gas-works tar.—Actual value is 30s. to 32s. per ton *ex* works in bulk.

Pitch.—New business is scarce, but quotations are maintained at 43s. to 44s. per ton f.o.b. Glasgow for export and 42s. 6d. per ton *ex* works in bulk for home trade.

Refined tar is slow with value easy at 3d. to 3½d. per gallon f.o.r. naked.

Creosote Oil.—Values of all grades are steady. B.E.S.A. Specification, 3¾d. to 4d. per gallon; low gravity, 4¼d. to 4½d. per gallon; and neutral oil, 4d. to 4¼d. per gallon; all f.o.r. in bulk.

Cresylic acid.—Inquiries are quite numerous, but there is not much movement. Pale, 97/99%, is 1s. 2½d. to 1s. 3½d. per gallon; dark, 97/99%, 1s. 0½d. to 1s. 1½d. per gallon; and pale, 99/100%, 1s. 4d. to 1s. 5d. per gallon; all *ex* works.

Crude naphtha is only available in small quantities which command 4½d. to 5d. per gallon f.o.r, according to quality and district.

Solvent naphtha.—90/160 grade is 1s. 3d. to 1s. 4d. per gallon, and 90/190 grade is round 8d. to 9d. per gallon, according to quantity.

Motor benzole is not more than 1s. 4d. per gallon.

Pyridines.—90/160 grade is 6s. to 6s. 6d. per gallon, and 90/140 grade 6s. 6d. to 7s. per gallon.

Benzole Prices.

These are considered to be the market prices for benzole at the present time:

	s. d.		s. d.	
Crude benzole	0 9	to	0 9¾	per gallon at works
Motor "	1 3½	"	1 4	" " "
90% "	1 4	"	1 4½	" " "
Pure "	1 7½	"	1 8	" " "

Contracts Advertised To-Day.

Main and Service Laying.

Birmingham Corporation Gas Department. [p. 905.]

Pipes.

Skipton Gas Department. [p. 905.]

Trade Notes.

James Keith & Blackman Company, Ltd.

Two booklets, one dealing with the "Keith" rotary compressors for air or gas and the other with automatic mixture control for gas-heated commercial appliances, have been forwarded to us by Messrs. James Keith & Blackman Co., Ltd., 27, Farringdon Avenue, E.C. 4. The rotary compressors are recommended for producing a pressure or vacuum up to 5 lbs. per sq. in. Pressures in excess of this may be obtained by coupling in series.

Brayshaw Furnaces & Tools, Ltd.

We have received an illustrated catalogue from the Brayshaw Furnaces & Tools Company, Belle Vue Works, Manchester, 12. This catalogue gives details of many of the types of plant supplied by the firm for the modern methods of ferrous and non-ferrous heat treatment. The Company also supply special furnaces to meet any requirements. Of particular interest to the Gas Industry, this publication gives some details of a gas-heated incinerator for cleaning cookers prior to enamelling.

New Capital Issues.

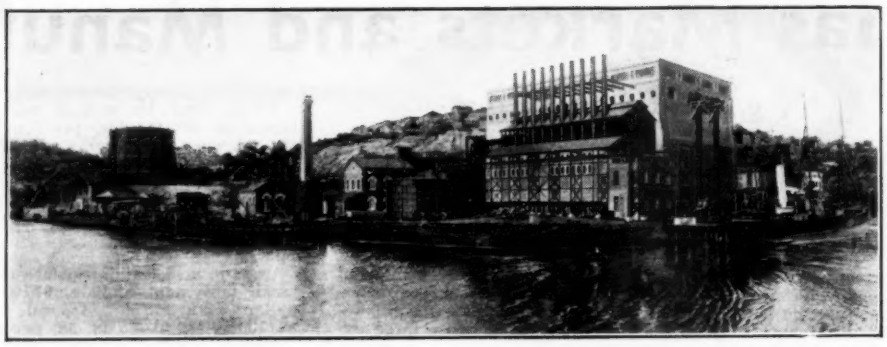
South Suburban Gas Company.—Tenders for the recent issue of £200,000 4% perpetual preference stock by this Company ranged from the minimum price of 105% to 115½%, the average price obtained being £106 10s. 8·44d. The number of tenders received was 261, and the total amount subscribed was £542,995.

Diaries, Calendars, &c.

Seasonable gifts in the form of diaries, calendars, &c., have been received from the undermentioned friends, whose good wishes are heartily reciprocated:

Staveley Coal and Iron Company, Ltd., nr. Chesterfield.
Parkinson Stove Company, Ltd., Stechford, Birmingham.
John G. Stein & Co., Ltd., Bonnybridge, Scotland.
Westwood & Wrights, Ltd., Round Oak, Brierley Hill, Staffs.
Standard Furnace and Setting Company, Lord Street, Southport.

The installation of Glover-West vertical retorts at the works of the North Shore Gas Company of Sydney, N.S.W.



Another repeat order for West's carbonizing plant

From the North Shore Gas Company of Sydney, New South Wales, we have received a contract for an installation of Westvertical carbonizing chambers with an estimated daily capacity of 3 million cubic feet. The new unit will augment the present Glover-West vertical retort plant at the North Shore works, and both will be served by an extensive new coal and coke handling plant.

WEST'S CARBONIZING & FUEL-HANDLING SYSTEMS

GLOVER-WEST VERTICAL RETORTS . . . . . WESTVERTICAL CARBONIZING CHAMBERS

THE WEST LIP-BUCKET CONVEYOR WITH AUTOMATIC FORCED LUBRICATION . . . ALL TYPES OF CONVEYORS, ELEVATORS AND SKIP-HOISTS . . . COKE CRADERS . . . BREEZE-BURNING PRODUCER EQUIPMENT . . . ETC., ETC.

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'PHONE: HOLBORN 4108. 'GRAMS: "IMVERTRET, WESTCENT."

MANCHESTER: MILES PLATTING, MANCHESTER, 10
'PHONE: COLLYHURST 2961. 'GRAMS: "STOKER, MANCHESTER"

STOCK AND SHARE LIST.

Official Quotations on the London and Provincial Stock Exchanges.

Issue. £	Share.	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations Dec. 14.	Rise or Fall on Week.	Transactions. Lowest and Highest Prices During the Week.
1,551,868	Stk.	Sept 10	7	7	Alliance & Dublin Ord. ...	135—145	...	...
874,000	"	June 25	4	4	Do. 4 p.c. Deb. ...	90—100	...	...
557,655	"	Aug. 13	7	7	Barnet Ord. 7 p.c.	168—173	...	170
300,000	1	Oct. 8	1/9⅜	1/4⅜	Bombay, Ltd	1⅜—1⅝	...	33/9
178,480	Stk.	Aug. 13	9½	9½	Bournemouth sliding scale	227—237	...	...
550,050	"	"	7	7	Do. 7 p.c. max. ...	170—175	...	172½
489,160	"	"	6	6	Do. 6 p.c. Pref. ...	150—155	...	...
50,000	"	June 11	3	3	Do. 3 p.c. Deb. ...	87—92	...	...
262,025	"	"	4	4	Do. 4 p.c. Deb. ...	105—110	...	109½
335,000	"	"	5	5	Do. 5 p.c. Deb. ...	125—130	...	...
357,900	"	Aug. 13	7½	7½	Brighton, &c., 6 p.c. Con. ...	175—185	...	184—185
540,000	"	"	6⅔	6⅔	Do. 5 p.c. Con. ...	158—163	...	...
195,500	"	"	6	6	Do. 6 p.c. B. Pref.	145—150	...	...
1,487,500	"	July 9	5	5	Bristol 5 p.c. max.	120—122*a*	...	...
190,420	"	June 11	4	4	Do. 1st 4 p.c. Deb. ...	103—106*a*	...	...
217,870	"	"	4	4	Do. 2nd 4 p.c. Deb. ...	103—106*a*	...	...
328,790	"	"	5	5	Do. 5 p.c. Deb.	123—125*a*	...	...
855,000	"	Sept. 24	8	7	British Ord.	174—179	...	176
100,000	"	June 11	7	7	Do. 7 p.c. Pref.	158—163	...	...
120,000	"	"	4	4	Do. 4 p.c. Red. Deb. ...	98—103	...	...
450,000	"	"	5	5	Do. 5 p.c. Red. Deb. ...	110—115	...	...
100,000	10	22 May '33	6	4	Cape Town, Ltd.	2—4	...	...
100,000	10	Nov. 6	4½	4½	Do. 4½ p.c. Pref. ...	4—6	...	...
150,000	Stk.	July 23	4½	4½	Do. 4½ p.c. Deb. ...	90—95	...	...
626,560	"	July 23	6	6	Cardiff Con. Ord.	135—140	...	...
287,860	"	June 11	5	5	Do. 5 p.c. Red. Deb.	107—112	...	...
157,150	"	July 23	5½	5	Chester 5 p.c. Ord.	113—118*b*	...	...
98,936	1	Sept. 24	2/-	2/-	Colombo, Ltd. Ord.	1⅞—1⅞	...	...
24,500	1	"	1/4½	1/4½	Do. 7 p.c. Pref. ...	19/6 - 21/6	...	...
609,204	1	Sept. 24	/11'48	/11'48	Colonial Gas Assn. Ltd. Ord.	19/6—21/6	...	...
296,058	1	"	1/8'30	1/8'30	Do. 8 p.c. Pref.	24/6—26/6	...	...
1,775,005	Stk.	July 23	6½	5	Commercial Ord.	122—127	...	121
475,000	"	Dec. 3	8	8	Do. 8 p.c. Deb. ...	87—91*	...	86
286,344	"	Aug. 13	5	5	Do. 5 p.c. Deb. ...	122—127	...	...
807,560	"	Aug. 13	7	7	Croydon sliding scale ...	165—170	...	168
569,590	"	"	5	5	Do. max. div.	112—117	...	115—120
620,385	"	June 25	5	5	Do. 5 p.c. Deb.... ...	128—130	+2	126
542,270	"	Aug. 13	10	7	Derby Con.	195—205*e*	...	...
55,000	"	June 25	4	4	Do. 4 p.c. Deb.	100—105*e*	...	...
209,000	"	Aug. 13	5	5	East Hull Ord. 5 p.c. ...	113—118	...	116½
181,625	"	Aug. 13	6	6	East Surrey Ord. 5 p.c. ...	137—142	...	...
175,809	"	June 11	5	5	Do. 5 p.c. Deb. ...	120—126	...	...
1,002,180	"	Sept 10	†7	†5	European, Ltd.	122—127	...	120—122
19,343,763	"	Aug. 13	5⅝	5⅝	Gas Light & Coke 4 p.c. Ord.	27/9—28/9*f*	—⅜	27/9—28/6
2,600,000	"	"	3½	3½	Do. 3½ p.c. max. ..	93—97	..	9⅜—96½
4,477,106	"	"	4	4	Do. 4 p.c. Con. Pref. ...	108—111	—.	110 111
6,102,497	"	Dec. 3	3	3	Do. 3 p.c. Con. Deb. ...	89 92*	..	89½—91
3,643,770	"	"	5	5	Do. 5 p.c. Red. Deb. ...	118—121*	...	118—119
3,500,000	"	"	4½	4½	Do. 4½ p.c. Red. Deb. ...	116—119*	...	117½—118½
270,466	"	Aug. 13	6	6	Harrogate New Cons. ...	140—145	...	...
140,000	1	Sept. 24	1/7½	1/7½	Hongkong & China, Ltd. ...	1⅜—1⅝	...	...
218,200	Stk.	Aug. 13	6	6	Hornsey Con. 5½ p.c. ...	187—142	...	...
5,500,000	"	Oct. 22	14	10	Imperial Continental Cap.	212—222	+2	214—220
228,130	"	July 23	3½	3½	Do. 3½ p.c. Red. Deb.	92—97	...	...
235,242	"	Aug. 13	8½	8½	Lea Bridge 5 p.c. Ord. ...	196—200	...	...
2,157,410	"	Aug. 13	6	6	Liverpool 5 p.c. Ord. ...	142½—144½*b*	...	...
245,500	"	June 11	5	5	Do 5 p.c. Red. Pref. ...	105—110*b*	...	...
306,083	"	July 16	4	4	Do. 4 p.c. Deb. ...	103—106*b*	...	...
11,751	"	Aug 27	10	8	Maidstone 5 p.c. Cap. ..	84—89	...	...
63,480	"	June 25	3	3	Do. 3 p.c. Deb. ...	195—205*	...	...
75,000	"	Dec. 3	†10	†10	Malta & Mediterranean ... Metropolitan (of Melbourne)			
392,000	—	Oct. 1	5½	5½	5½ p.c. Red. Deb.	100—103	...	102½—103
231,978	Stk.	Aug. 13	5	5	M. S. Utility "C." Cons. ...	115—120	...	...
818,657	"	"	4	4	Do. 4 p.c. Cons. Pref.	101—106	...	...
360,075	"	June 11	4	4	Do. 4 p.c. Deb. ...	102—107	...	...
148,955	"	"	5	†5	Do. 5 p.c. Deb. ...	124—130	+½	...
125,000	—	July 2	...	11/8	Do 3½ p.c. Rd. Rg.Bds.	99—102	+2	...
675,000	"	May 28	†6	†13	Montevideo, Ltd.	55—65	...	59
2,061,315	"	Aug. 13	6⅔	5	Newcastle & Gateshead Con.	26/6—27/-*df*	...	...
682,886	"	"	4	4	Do. 4 p.c. Pref. ...	105—107*d*	...	...
776,706	"	June 11	3½	3½	Do. 3½ p.c. Deb. ...	100—102	...	...
277,285	"	Oct. 8	5	5	Do. 5 p.c. Deb. '48 ...	105—107*d*	...	...
274,000	"	Aug. 13	5	5	Newport (Mon.) 5 p.c. max.	110—112*a*	...	...
204,940	"	Aug. 13	7½	7½	North Middlesex 6 p.c. Con.	170—175	...	...
336,160	"	Aug. 13	5	5	Northampton 5 p.c. max. ...	107—112	...	...
300,000	"	Nov. 5	†7	†9	Oriental, Ltd.	166—171	...	170
416,617	"	June 11	8	8	Plym'th & Stonehouse 5 p.c.	183—188	...	...
504,416	"	Aug. 13	8	8	Portsm'th Con.Stk. 4 p.c.Std'	182—187	...	...
241,446	"	"	5	5	Do. 5 p.c. max. ...	110—115	...	...
114,000	"	July 23	5	5	Preston 5 p.c. Pref.	101—106	...	...
1,736,968	Stk.	Aug. 27	6	6	Sheffield Cons.	144—146*e*	+1	...
95,000	"	July 9	4	4	Do. 4 p.c. Deb.	100—104*	...	...
138,201	"	Aug. 13	5	5½	Shrewsbury 5 p.c. Ord. ...	154—159	...	...
90,000	10	May 28	†4	†3	South African	3—4	...	...
927,177	1	Sep. 10	1/22½	1/22½	South-East'n Gas Cn. Ld Ord.	30/6—32/6	...	31/—31/6
736,061	1	"	-/10½	-/10½	Do. 4½ p.c. Red.Cum.Pref.	22/6—23/6	...	22/9
450,000	Stk.	Aug. 13	74/4	4	Do. 4 p.c. Red. Deb. ...	102—105	...	...
6,709,895	"	Aug. 13	7	5	South Met. Ord.	148—153	—2	148—150
1,135,812	"	"	6	6	Do. 6 p.c. Irred. Pf.	148—153	...	153
850,000	"	"	4	4	Do. 4 p.c. Irred. Pf.	107—110	...	108—108½
1,895,445	"	June 25	3	3	Do. 3 p.c. Deb. ...	90—93	...	90—92½
1 000,000	"	July 9	5	5	Do. 5 p.c. Red. Deb.	117—121	...	120½
209,810	"	Aug. 13	8½	8½	South Shields Con.	185—187*d*	...	...
1,548,795	"	July 9	6	6	South Suburban Ord. 5 p.c.	144—149	...	146—148½
512,895	"	"	5	5	Do. 5 p.c. Pref.	124—129	...	...
300,000	"	"	4	4	Do. 4 p.c. Pref.	105—110	+3	108
868,887	"	June 11	5	5	Do. 5 p.c. Deb.	127—132	+2	126
100,000	"	"	4	4	Do. 4 p.c. Deb.	108—113	...	112½
647,740	"	Aug. 13	5	5	Southampt'n Ord. 5 p.c. max.	118—123	...	...
121,275	"	June 11	4	4	Do. 4 p.c. Deb.	102—107	...	103
350,000	"	Aug. 13	5½	5½	Swansea 5½ p.c. Red. Pref.	114—119	+1	...
200,000	"	June 11	6½	6½	Do. 6½ p.c. Red. Deb.	102—107	...	...
1,076,490	"	Aug. 13	6⅔	6⅔	Tottenham and District Ord.	163—168	...	163½
409,835	"	"	5½	5½	Do. 5½ p.c. Pref. ...	130—135	...	134½
62,285	"	"	5	5	Do. 5 p.c. Pref. ...	122—127	...	...
199,005	"	Dec. 3	4	4	Do. 4 p.c. Deb. ...	101—106*	...	...
349,110	"	Aug. 13	7	7	Uxbridge, &c., 5 p.c. ...	165—170	...	169—170
88,330	"	"	5	5	Do. 5 p.c. Pref. ...	124—129	...	...
1,326,700	"	Aug. 13	7	7	Wandsworth Consolidated	168—173	+3	169—170½
1,371,373	"	"	5	5	Do. 5 p.c. Pref.	126—131	+2	128½
1,317,964	"	June 11	5	5	Do. 5 p.c. Deb.	132—137	+7	129 - 135
208,300	"	"	...	26/8	Do. 4 p.c. Deb.	107—110	...	...
158,400	"	Aug 13	6*g*	5	Winchester W.& G.5 p.c.Con.	120—125	...	...

Quotations at:—*a.*—Bristol. *b.*—Liverpool. *c.*—Nottingham. *d.*—Newcastle. *e.*—Sheffield. *f.*—The quotation is per £1 of stock. *g.*—Paid £8, including 10s. on account of back dividends. * Ex. div. † Paid free of income-tax. ‡ For year.

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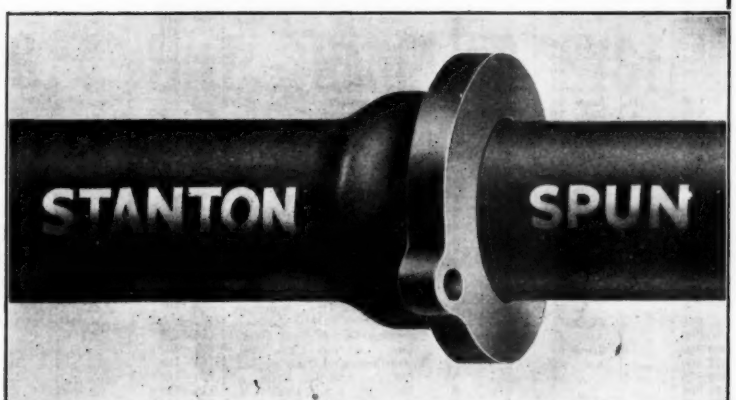

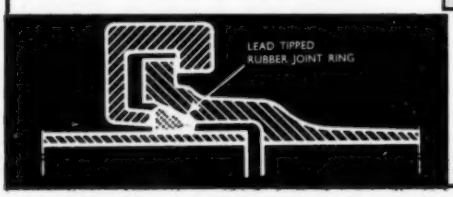

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